Using the profile of CEOs to detect earnings management

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Abstract

This paper develops a composite score, namely PSCORE, to capture the profile of chief executive officers and examines how well PSCORE could signal the presence of earnings management. PSCORE aggregates nine aspects across four dimensions of the profile of chief executive officers, including financial expertise, reputation, internal power and age. We find that PSCORE is positively correlated with many empirical proxies of earnings management, including discretionary accruals, proxies for real earnings management and deviations of the first digits of figures reported in financial statements from what are expected by Benford's Law. The findings suggest that having a general assessment of the profile of chief executive officers could signal the presence of earnings management.

Keywords: earnings management detection models; Benford's Law; chief executive officers; reputation; financial expertise

1. INTRODUCTION

A substantial body of the existing literature is dedicated to developing, validating and improving empirical models to detect earnings management. The paper is motivated to make further contributions to the literature by introducing a new approach which captures the profile of chief executive officers (CEOs hereafter) to signal the presence of earnings management.

Despite their importance, earnings management detection models are subject to considerable criticisms (Ball, 2013; Dechow, Ge, & Schrand, 2010; Fields, Lys, & Vincent, 2001; Holthausen, Larcker, & Sloan, 1995; Owens, Wu, & Zimmerman, 2013). Most widely-used models rely on firms' characteristics to estimate the managed portion of reported earnings resulting from using accounting accruals (e.g., Dechow & Dichev, 2002; Dechow, Sloan, & Sweeney, 1995; Jones, 1991; Kothari, Leone, & Wasley, 2005; Peasnell, Pope, & Young, 2000b) or from constructing real business transactions (e.g., Roychowdhury, 2006). However, the studies fail to consider characteristics of top managers such as CEOs. Given that CEOs have overall responsibilities for the performance of firms, they possibly influence financial statements which present the financial performance, financial position and cash flows of their firms. The characteristics of CEOs such as experiences, values and personalities are important because accounting standards allow judgments in choosing appropriate accounting policies or in estimating accounting numbers under some uncertainties.

In addition, another major limitation of accrual-based models is the absence of an adequate understanding about the properties of accruals and a theory of accrual-generating process, therefore the large magnitude of regression residuals may be contributable to earnings management (Ball, 2013; Dechow et al., 2010; Fields et al., 2001; Gerakos, 2012; Owens et al., 2013). There is also increasing concern that accrual-based models are poorly specified (Ball, 2013; Dechow et al., 2010; Fields et al., 2001; Holthausen et al., 1995; Owens et al., 2013) or there may be measurement errors in estimating accruals (Hribar & Collins, 2002).

Furthermore, the next limitation of the above models is that they normally require large data to run time-series or cross-sectional regressions, thus their application could be limited because of possible data constraints (Amiram, Bozanic, & Rouen, 2015; Dechow, Ge, Larson, & Sloan, 2011; Dechow et al., 1995; Nguyen, Iqbal, & Shiwakoti, 2015b). In some capital markets, especially in developing countries, data needed to calculate empirical proxies of earnings management may be difficult to access for some financial statement users such as individual investors.

Lastly, so far, very little attention is paid to developing a model to detect both types of earnings management. Empirical models detect either accrual earnings management (e.g., Dechow & Dichev, 2002; Dechow et al., 1995; Jones, 1991; Kothari et al., 2005; Peasnell et al., 2000b) or real earnings management (e.g., Roychowdhury, 2006). However, CEOs may have different ways to affect the bottom lines of financial statements, for example they can manipulate earnings by constructing real business transactions or biasedly applying accounting standards to record those transactions in financial statements. Therefore, practitioners possibly prefer a model which could detect both accrual and real earnings management.

The paper aims to address the above gaps of the literature by constructing a composite score, namely PSCORE, to signal the presence of earnings management. PSCORE requires data mostly collected from the curriculum vitae of CEOs, hence, it could be advantageous compared to the existing models. Based on prior research, PSCORE has nine factors which cover the financial expertise, reputation, internal power and age of CEOs. The financial expertise captures role experience, previous working experience as a chief financial officer, and finance-related qualifications. The reputation captures yearly years of service in the firm, returns on assets during the last three years of CEOs' tenure, and press coverage. The internal power identifies CEOs who serve as the chairman (or chairwoman) or founder of firms. If prior research shows that an individual factor suggests the presence of earnings management, we add one to the composite PSCORE, zero otherwise. As a result, PSCORE is an integer with a value theoretically ranging from zero to nine.

The main tests of the paper examine if PSCORE is positively correlated with other established proxies of earnings management. First of all, we examine how PSCORE is related with accrual and real earnings management, two of the most popularly-used proxies of earnings management. Discretionary accruals are estimated by the modified-Jones model (Dechow et al., 1995; Jones, 1991) and the margin model (Peasnell et al., 2000b). The empirical models of Roychowdhury (2006) are employed to estimate abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures, which are the proxies of real earnings management. Similar to previous studies (e.g, Armstrong, Larcker, Ormazabal, & Taylor, 2013; Bergstresser & Philippon, 2006; Jiang, Petroni, & Yanyan Wang, 2010), we use absolute values of accrual and real earnings management. Next, following Amiram et al. (2015) to study the distributional probability of the first digits of figures reported in financial statements, we examine how PSCORE is correlated with the deviations of the first digits from Benford's Law.

Using a sample of 3,396 firm-year observations (615 unique firms) of listed companies in the London Stock Exchange from 2005 to 2012, the results show strong correlations between PSCORE and the established proxies of earnings management, suggesting that PSCORE could signal the presence of earnings management. Specifically, the findings indicate that all employed measures of earnings management increases monotonically as PSCORE increases. Mean differences in earnings management between the low-PSCORE group (PSCORE equals to zero, one, or two) and the high-PSCORE group (PSCORE equals to six, seven, or eight[2]) are statistically significant. Additionally, the associations between PSCORE and the other measures of earnings management remain significant after controlling for key determinants of earnings management such as equity issuance, corporate governance factors and firm characteristics. The findings are robust across different models, including different ways to estimate discretionary accruals and different ways to calculate PSCORE, and different sample selections.

The research contributes to the literature and practice in several ways. First, the paper is the first research which aggregates various characteristics of CEOs into a single index to capture the presence of earnings management. Previous published studies are limited to the effects of individual characteristics of CEOs on earnings management (e.g., Ali & Zhang, 2015; Francis, Huang, Rajgopal, & Zang, 2008; Huang, Rose-Green, & Lee, 2012; Jiang et al., 2010; Kuang, Qin, & Wielhouwer, 2014; Malmendier & Tate, 2009; Wells, 2002). Therefore, the paper provides an exciting opportunity to advance our knowledge of the involvement of CEOs in earnings management activities. Second, compared to other proxies of earnings management, PSCORE is much easier to calculate. Similar to recent studies (e.g., Amiram et al., 2015; Dechow et al., 2011), our approach neither requires time-series or cross-sectional data nor needs a model to estimate. Data used to construct PSCORE are mostly obtained from the curriculum vitae of CEOs. Third, PSCORE developed in the paper could capture both accrual and real earnings management. Practitioners would value PSCORE because it could detect the ultimate impact of discretion over financial statements regardless of earnings management methods used by CEOs. Four, in the contexts of auditing, external auditors could employ PSCORE as a tool to assess the risks of material misstatements. Auditing standards (e.g, International Auditing and Assurance Standards Board, 2009; Public Company Accounting Oversight Board, 2010) require that the risk assessment procedures of auditors must include an understanding about the entity and its environment, including the management's philosophy and operating style. Aggressive earnings management might result from the inappropriate applications of accounting standards so that it

[2] *PSCORE empirically varies from zero to eight.*

could be a red flag of material misstatements. The evidence implies that auditors should be cautious with the risks of material misstatements in firms having CEOs with high PSCORE. Five, the board of directors could use PSCORE to have a quick check about the profile of CEOs when making decisions about hiring a new CEO. The paper suggests that CEOs with low PSCORE are less likely to engage in earnings management activities, therefore they might help firms to improve the quality of financial reporting in general. Other practitioners such as investors could also use PSCORE to assess the reliability of financial statements for decision-making processes.

The remaining part of the paper proceeds as follows. Section 2 gives an overview of the literature on earnings management detection models. Section 3 explains the construction of PSCORE. Section 4 describes the validity tests of PSCORE, focusing on the sample selection, calculation of empirical proxies, control variables, regression models and findings. Section 5 provides some concluding remarks.

2. LITERATURE REVIEW

2.1. Earnings management detection models

Earnings management can be generally described as exercising managerial discretion in applying accounting standards or constructing real business transactions to affect reported earnings in financial statements (Healy & Wahlen, 1999). In the last decades, there has been an increasing amount of literature on searching for empirical models to detect earnings management. However, most studies have some significant limitations. In this section, we overview some widely applied models and identify opportunities to further complement the existing literature on earnings management detection models.

Empirical models to detect accrual earnings management

Research on models to accrual earning management focuses on estimating discretionary accruals, which are viewed as the discretion of managers over financial statements. Early models treat working capital accruals as a proxy of earnings management. For example, Healy (1985) uses the levels of working capital accruals as discretionary accruals and DeAngelo (1986) uses changes in working capital accruals. Those models are criticized because they implicitly assume that nondiscretionary accruals are constant, which may not be true as Kaplan (1985) and McNichols (2002) suggest that nondiscretionary accruals change when economic situations change.

Later research develops more complicated models which isolate discretionary accruals from nondiscretionary accruals, among which the most influential models are variants of the modified-Jones model (Dechow et al., 1995; Jones, 1991; Kothari et al., 2005) and Dechow and Dichev (2002) model. Jones (1991) introduces a model to estimate nondiscretionary accruals by reflecting changes in economic circumstances. In this model, nondiscretionary accruals are regressed on changes in revenues and property, plant and equipment (scaled by opening assets). The differences between actual accruals and nondiscretionary accruals are discretionary accruals, which are used as a proxy of earnings management. Despite its importance, as noted by Jones (1991), the model is biased when revenues are managed. To avoid manipulation in revenues, Dechow et al. (1995) modify the Jones model by using cash revenues rather than credit revenues. The new model is commonly known as the modified-Jones model. Kothari et al. (2005) further improve the Jones and the modified-Jones models by matching firm-year observations based on the closest return on assets (ROA), but the performance-matched model may reduce test power (Dechow et al., 2010).

Another of most cited studies is that of Dechow and Dichev (2002) who propose an alternative model to estimate nondiscretionary working capital accruals. In this model, working capital accruals are regressed on past, present and future cash flows because working capital accruals related to cash payments or collections reverse when cash is paid or received. The standard deviations of regression residuals are used as a proxy of earnings management. However, an important limitation of the model of Dechow and Dichev (2002) is that it ignores long term accruals. Francis, LaFond, Olsson, and Schipper (2005) extend the model of Dechow and Dichev (2002) by adding sales growth to control for firm performance and adding property plant and equipment to include depreciation accruals (which are a type of long term accruals). Francis et al. (2005) also attempt to differentiate discretion estimation errors from *innate* estimation errors, however, this process may introduce bias because the estimation errors may also result from the *innate* characteristics (Dechow et al., 2010). Since Dechow and Dichev (2002), there is no technical improvement in isolating discretionary accruals from nondiscretionary accruals (Gerakos, 2012).

While there are various models detecting earnings management, empirical research shows that no other model outperforms the modified-Jones model in the United States (US) (Dechow et al., 1995) and the United Kingdom (UK) (Peasnell et al., 2000b). In the contexts of the UK, Peasnell et al. (2000b) also introduce the "margin model" which is most effective in detecting accrual earnings management when cash flows are extreme.

Empirical models to detect real earnings management

With respect to real earnings management, Roychowdhury (2006) develops models to detect the manipulation of real business activities to affect the bottom lines of financial statements. Managers may construct real activities such as providing increased price discounts or more lenient credit terms, overproductions, or reductions in discretionary expenditures. Those activities would affect cash flows from operations, production costs and discretionary expenditures of firms. Similar to Jones (1991) and Dechow et al. (1995), Roychowdhury (2006) firstly use firms' revenues and changes in revenues (scaled by opening assets) to estimates normal cash flows from operations, normal production costs, and normal discretionary expenditures. The differences between actual and estimated values are abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures which are used as the proxies of real earnings management. Later research shows that those models are able to detect real earnings management both in the US (Cohen, Dey, & Lys, 2008; Cohen & Zarowin, 2010; Gunny, 2010; Zang, 2012) and in the UK (Athanasakou, Strong, & Walker, 2011; Athanasakou, Strong, & Walker, 2009).

Models to signal the presence of earnings management

In addition to empirical models to detect earnings management, a number of studies attempt to develop techniques to signal the presence of earnings management. An influential direction is to use firms' characteristics and industry benchmarks to predict earnings management. Some research uses firms' accounting ratios to differentiate manipulators of Generally Accepted Accounting Principles (GAAP) from "aggressive accruers", which are firms with high accruals (Beneish, 1997), or from non-manipulators (Beneish, 1999). However, the above approaches require accounting indexes which need large data to construct or require matched control samples to run probit regressions. In a similar way with Beneish's approaches (Beneish, 1997, 1999), Nguyen et al. (2015b) introduce a score, namely ESCORE, which captures the context of firms with high earnings management. ESCORE is a composite index which includes 15 separate dummy variables with values of one or zero based on corresponding benchmarks. They show that ESCORE is able to capture both accrual and real earnings management. Nguyen et al. (2015b) definitely complement to earnings management detection models by taking into account the surrounding contexts of firms rather than relying on only financial statement data. Nevertheless, similar to Beneish's approaches (Beneish, 1997, 1999), ESCORE needs industry benchmarks to calculate.

Another stream of research focuses on searching for techniques which use only firm-year data to signal the presence of earnings management. Also built on and complementary to Beneish's approaches (Beneish, 1997, 1999), Dechow et al. (2011) develop a score namely F-SCORE, which can be directly calculated from financial statements of a random firm, to predict accounting misstatements. Dechow et al. (2011) provide evidence that, in addition to accruals, other information obtained from financial statements may be useful to determine accounting manipulations. Within the same theme, Amiram et al. (2015) study the distributional probability of the first digits of figures reported in financial statements and develop an innovative FSD_SCORE, which is the mean absolute deviation of the first digits from Benford's Law, to use as a proxy of earnings management. Amiram et al. (2015) mathematically prove that an introduction of errors to financial statement results in more divergences of the first digits from Benford's Law. They find that FSD_SCORE is correlated with earnings management and is helpful to predict material accounting misstatements. Compared with other earnings management proxies, FSD_SCORE has some significant advantages (Amiram et al., 2015). Firstly, FSD_SCORE needs only firm-year data to calculate. Secondly, FSD_SCORE does not need a model to estimate and it is simply statistics without biases. Last but not least, it is likely that there is no *ex ante* relationship between FSD_SCORE and firm characteristics and firm performance. In the contexts of the UK, FSD_SCORE has even more potential because of the lack of data similar to the US (such as accounting restatements enforced by the US Government Accountability Office or Accounting and Auditing Enforcement Releases (AAER) from the US Securities and Exchange Commssion). To date, there is neither an accounting research employing FSD_SCORE as a proxy of earnings management nor a paper studying the relationship between the characteristics of CEOs and FSD_SCORE.

Limitations of empirical models to detect or signal earnings management

Despite their importance, the above mentioned models suffer from several major drawbacks. First, the above mentioned models only take into account the characteristics or the surrounding contexts of firms but ignore the characteristics of top managers such as CEOs, who may have significant influence on financial statements. While empirical research on CEOs suggests that the characteristics of CEOs may play an important role in explaining earnings management practice (e.g., Feng, Ge, Luo, & Shevlin, 2011; Francis et al., 2008; Huang et al., 2012; Serfling, 2014; Yim, 2013), the existing literature does not document any model which embraces various characteristics of CEOs to detect earnings management.

Second, the literature neither adequately explains the properties of stochastic nondiscretionary accruals and discretionary accruals nor theorizes accrual-generating process (Gerakos, 2012). Large magnitude of regression residuals may be contributable to earnings management, potentially leading to incorrect inference (Ball, 2013; Dechow et al., 2010; Fields et al., 2001; Gerakos, 2012; Owens et al., 2013).

Third, there may be measurement errors in estimating accruals. On one hand, Hribar and Collins (2002) challenge the use of working capital accruals to estimate discretionary accruals by indicating that changes in working capital accruals may contribute to both operating and non-operating transactions (such as reclassifications, acquisitions, divestitures, accounting changes, and foreign currency translations) which violate the assumption that there is an articulation between changes in working capital accounts in the balance sheet and income statement. In other words, they argue that the relationship between working capital accounts and reported earnings is ambiguous. On the other hand, using total accruals to estimate discretionary accruals is controversial (see, e.g., Botsari & Meeks, 2008). Total accruals include depreciation accruals which are not a potential tool to manage earnings because depreciation is visible, rigid and predictable (Young, 1999), then the manipulation in depreciation is easily detected by auditors. Empirical evidence shows that managers do not use depreciation accruals to smooth earnings (Hunt, Moyer, & Shevlin, 1996). In general, previous studies suggest that there is no perfect formula to calculate accruals without bias.

Four, there is increasing concern that accrual-based models are poorly specified. Jones-type models may result in correlations between residuals and firm performance (Ball, 2013; Dechow et al., 2010; Fields et al., 2001; Owens et al., 2013). Although researchers attempt to address this issue by improving Jones-type models (e.g., Kothari et al., 2005) or developing new approaches to estimate discretionary accruals (e.g., Dechow & Dichev, 2002), Dechow et al. (2010) argue that alternative models are not free from bias. Because models to detect real earnings management are constructed in the same way with accrual-based models, they may also face poor misspecifications (Nguyen et al., 2015b).

Along with the limitations discussed above, practitioners may face some difficulties in applying the existing models in practice. One of the main obstacles of accrual-based models and real earnings management models is that they need time-series data or cross-sectional data to estimate firm-year earnings management. The application of those models may be limited because of possible data constraints in some capital markets. Another disadvantage of most models mentioned above is that they can detect either accrual or real earnings management, but not both. Although Nguyen et al. (2015b) somehow fulfil the need of practitioners, there may be further demand for an alternative approach to address both accrual and real earnings management.

In summary, earnings management detection models are subject to considerable criticisms despite their wide application. The paper further extends this growing body of literature by aggregating various characteristics of CEOs into a single index, namely PSCORE, to capture both accrual and real earnings management. PSCORE is easy to construct, therefore it could provide much convenience for practitioners. The following section explains the theoretical background and empirical evidence of research on the characteristics of CEOs and earnings management.

2.2. Why do the characteristics of chief executive officers matter?

Different theories exist in the literature regarding the effects of working experience and personalities of CEOs on corporate practices. The upper echelons theory proposes that the decision-making process of executive managers is affected by the way managers interpret the strategic situations when they face them, and managers' interpretation is determined by personal characteristics such as experiences and personalities (Hambrick, 2007; Hambrick & Mason, 1984). Under the upper echelons theory, it is predicted that organisational outcomes are directly determined by the discretion of top executive managers (Hambrick, Finkelstein, & Mooney, 2005). Because reported earnings is a type of organisational outcomes, it is reasonable to predict that the characteristics of top managers such as CEOs play an important role in determining earnings management, given that accounting standards allows managerial judgment and discretion over various accounting treatments[3]. Empirical research generally supports the notion that earnings management is affected by managers' characteristics. For example, Francis et al. (2008) find that firms suffering low earnings quality, or high earnings management, are more likely to hire reputable CEOs because the companies need the skills as well as the talent of the reputable CEOs. Aier, Comprix, Gunlock, and Lee (2005) provide evidence that the financial expertise of chief financial officers negatively affects accounting restatement. Huang et al. (2012), Yim (2013) and Serfling (2014) find that the age of CEOs affects earnings management.

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[3] *For an overview of judgment and decision-making research in accounting, see Bonner (1999) and Trotman, Tan, and Ang (2011).*

With regard to reputation, there is good theoretical foundation to expect that the reputation of CEOs matters in the context of corporate practices. On one hand, the rent extraction theory predicts that the reputation of senior managers negatively affects organisational outcomes (Hirshleifer, 1993; Hirshleifer & Thakor, 1992; Malmendier & Tate, 2009). Under this theory, managers opportunistically make business decisions to enhance their reputation rather than to maximize shareholders' value. On the other hand, the efficient contracting theory and the matching theory support the hypothesis that the reputation of senior managers positively affects the organisational outcomes (Baik, Farber, & Lee, 2011; Francis et al., 2008; Jian & Lee, 2011; Milbourn, 2003; Wade, Porac, Pollock, & Graffin, 2006). The efficient contracting theory predicts that executives with high credibility (such as reputation) lead to high quality organisational outcomes because they have more to lose (compensation, future career etc.) if they are involved in activities which are harmful for the organisations (Francis et al., 2008; Jian & Lee, 2011). Empirical evidence in accounting research supports the predictions of the efficient contracting theory (e.g, Baik et al., 2011; Jian & Lee, 2011; Milbourn, 2003; Wade et al., 2006). Turning now to the matching theory which is introduced by Francis et al. (2008), the theory suggests that companies with high earnings management would hire reputable CEOs from outside because the firms need the expertise of the new CEOs. Francis et al. (2008) find no evidence that, after being hired, the reputable CEOs positively impact earnings management. While the findings of Francis et al. (2008) indirectly support their matching theory, there is direct evidence that firms hire relevant CEOs from the job markets (Joos, Leone, & Zimmerman, 2003).

Taken together, it has been shown from this review that the theories predict that earnings management is affected by the profile of CEOs including working experience, reputation and personalities. The next section provides details of the construction of PSCORE which captures the profile of CEOs.

3. CONSTRUCTION OF PSCORE

As discussed above, theoretical background supports the view that various characteristics of CEOs such as working experience, reputation and personalities would imply earnings management. Based on empirical evidence of previous research, the paper designs PSCORE which covers nine aspects of the characteristics of CEOs as follows.

3.1. Financial expertise

The first dimension of PSCORE is financial expertise which measures the financial background and experience of CEOs. Previous studies show that the financial expertise of audit committees constrains earnings management (Badolato, Donelson, & Ege, 2014; Bédard, Chtourou, & Courteau, 2004; Xie, Davidson, & DaDalt, 2003). Similarly, using finance-related working experience and qualifications as proxies of the financial expertise, Aier et al. (2005) find that the financial expertise of chief financial officers negatively impacts earnings restatements. With regard to CEOs, the financial expertise is also important because CEOs have legal duties to prepare true and fair financial statements. However, to date, there is no empirical evidence examining the effect of the financial expertise of CEOs on earnings management. While the literature documents that the financial expertise of CEOs affects financial policies (Custódio & Metzger, 2014), it is reasonable to expect that it also affects accounting practices such as earnings management. The paper contributes to the literature by using the financial expertise of CEOs to detect earnings management.

Following Aier et al. (2005), the paper establishes three proxies of financial expertise as follows: (i) Role experience of CEOs (pROLE), where pROLE equals to one if the number of years a CEO works as a chief executive officer is less than the corresponding industry-year mean (identify by Datastream level-six), zero otherwise; (ii) Working experience of CEOs as a chief financial officer (pCFO), where pCFO equals to one if a CEO does not have working experience as a chief financial officer, zero otherwise; and (iii) Advanced finance-related certification: a master of business administration (MBA) or a chartered professional accountant qualification (CPA) (pCERT), where pCERT equals to one if a CEO does not have a MBA or a CPA equivalent[4], zero otherwise. The rationale to use three above proxies is that CEOs may have different ways to gain financial expertise. CEOs may study an advanced finance-related certification. CEOs may also gain financial expertise if they have working experience as a chief financial officer because the chief financial officer position is directly responsible for the preparation of financial statements. Similarly, the role experience helps CEOs to accumulate financial expertise because CEOs have legal duties to prepare financial statements and may be involved with financial strategies and policies.

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[4] *CPA equivalent is defined as a professional accounting certification issued by one of five current qualifying bodies accredited by Financial Reporting Council (Financial Reporting Council, 2016): Association of International Accountants (AIA), Chartered Certified Accountants (ACCA), Chartered Accountants Ireland (CAI), Institute of Chartered Accountants in England and Wales (ICAEW), Institute of Chartered Accountants of Scotland (ICAS) (or international equivalent certifications).*

Having discussed so far the construction of three proxies of the financial expertise, the paper does not include working experience by serving as a member of audit committees. It can be observed that most corporate governance codes require the audit committees have at least one member with financial background (e.g, Financial Reporting Council, 2003; Financial Reporting Council, 2012). Therefore, a member of audit committee is most likely have a finance-related certification or work history, hence it has been captured by the other variables of the financial expertise.

3.2. Reputation

The second dimension of PSCORE is reputation. The existing body of research provides mixed evidence on the impact of the reputation of CEOs on earnings management. On one hand, Malmendier and Tate (2009) find that, following an award winning, "superstar" CEOs engage in earnings management to inflate firms' financial performance and extract higher compensation. The findings of Malmendier and Tate (2009) appear to be consistent with that of Wade et al. (2006) regarding to the negative affect of the reputation of CEOs on organisational outcomes in long term. However, the samples are unique, award-winning CEOs in the paper of Malmendier and Tate (2009) and CEOs selected as CEOs of the year in the study of Wade et al. (2006), thus the findings should not be generalized. On the other hand, Francis et al. (2008) find that the reputation of CEOs is significantly correlated with earnings management and firms having high earnings management are more likely to hire new CEOs who have better reputation than the preceding CEOs, but they find no evidence that, after being hired, the reputable CEOs positively impact earnings management. The findings of Francis et al. (2008) are consistent with previous studies on the reputation of CEOs (e.g., Jian & Lee, 2011) in the position that, in long term, reputable CEOs would lead to high quality organisational outcomes because they have more to lose (compensation, future career etc.) if they are involved in activities which are harmful for the organisations. It is now turning on a controversial issue is that if earnings management practice is a harmful activity for firms. While the consequences of accrual earnings management are debatable (see, for example, Dechow et al., 2010), the negative effects of real earnings management on the organisational outcomes are quite convinced. Real earnings management activities (such as providing increased price discounts or more lenient credit terms, overproduction or reduction of discretionary expenditures) consume real resources of firms, therefore they possibly result in declines in future performance (Cohen & Zarowin, 2010; Xu, Taylor, & Dugan, 2007). In the paper, we expect that reputable CEOs are less likely to engage in earnings management activities.

Based on prior research (Francis et al., 2008; Jian & Lee, 2011; Milbourn, 2003), the paper establishes three proxies for the reputation of CEOs as follows. The first proxy is industry-adjusted returns on assets during the last three years of CEOs' tenure (pROA). The rationale is that reputable CEOs should have generated high firm performance (Milbourn, 2003). We define pROA equals to one if the average of industry-adjusted returns on assets (aveROA) during the last three years of CEO's tenure is negative, zero otherwise; where aveROA is (i) the sum of industry-adjusted returns on assets[5] in year *t*, *t-1* and *t-2* if a CEO is on the third year of tenure, or (ii) the sum of industry-adjusted returns on assets in year *t* and *t-1* if a CEO is on the second year of tenure, or (iii) the industry-adjusted return on assets in year *t* if a CEO is on the first year of tenure.

The second proxy of the reputation is early years of service of CEOs in the firm (pEARLY), where pEARLY equals to one if a CEO is within the first three years of service in the firm, zero otherwise. The reason is that reputable CEOs should have longer tenure given that the board of directors acknowledge their performance (Milbourn, 2003). Empirical evidence also shows that earnings management is high in the first three years of service of CEOs because CEOs have incentives to show their ability when the perception of the market about CEOs is uncertain in the early years (Ali & Zhang, 2015; Kuang et al., 2014).

The third proxy of reputation is press coverage (pPRESS), where pPRESS equals to one if the number of newspapers which simultaneously cites the name of a CEO and the company the CEO is working for in a year is less than the corresponding industry mean (identified by Datastream level-six), zero otherwise. The rationale is that reputable CEOs should have been highly cited by the press (Milbourn, 2003). To measure press coverage, we begin with searching in LexisNexis using CEO's full name and company name as the key words. If there is no result, we search for first name and last name (omit middle name). In the LexisNexis database, we tick the options to eliminate duplicates, exclude non-business news, and restrict research results to UK national newspapers. UK National newspapers which are included in research results in LexisNexis database are Daily Star, Daily Star Sunday, Express Online, Independent Print Ltd, MailOnline, Morning Star, The Business, The Daily Mail and Mail on Sunday (London), The Daily Telegraph (London), Telegraph (London), telegraph.co.uk , The Express, The Guardian, The Independent (United Kingdom), The Mirror (The Daily Mirror and The Sunday Mirror), mirror.co.uk., The

[5] *The industry-adjusted return on assets is the difference between a firm's return on assets and the corresponding industry's mean (identified by Datastream level-six), where return on assets equals to net income before extraordinary items divided by total assets.*

Observer, The People, The Sunday, The Sunday Times (London), and The Times (London). We count all the number of newspapers in the search result. Although the above procedure to measure press coverage is subject to controversial, we believe that our measure reasonably captures the reputation of CEOs. Firstly, although Lafond (2008) doubts that not all news is good news for the reputation of CEOs, Milbourn (2003), Francis et al. (2008) and Jian and Lee (2011) show that total number of newspapers fairly presents the reputation of CEOs. Secondly, while prior studies open search results to worldwide newspapers (for example, Francis et al., 2008), we argue that if a worldwide newspaper has headlines about CEOs of UK listed companies, the news could also attract UK national newspapers, therefore expending research results to worldwide may include duplicates.

3.3. Internal power

The third dimension of PSCORE is internal power which captures the power of CEOs in the firm. In most companies, CEOs are powerful if they serve as the chairman of board of directors or founder of firms. Most corporate governance codes place strong accountabilities to the chairman position so that chairmen would play a very important role in monitoring activities including monitoring the integrity of financial reporting process (e.g., Financial Reporting Council, 2003, 2012). Founders are the people who open the businesses so that they would participate in all important business and financial policies of the companies. There is a large number of published studies presenting evidence that powerful CEOs are more likely to engage in earnings management activities. Dechow, Sloan, and Sweeney (1996) show that the board of directors of fraud firms are more likely to be dominated by management. They also find that firms are more likely to engage in earnings management when CEOs serve as the chairman of the board or founder of firms. Consistent with Dechow et al. (1996) and Feng et al. (2011), Farber (2005) also finds the duality role of CEO and chairman increases the likelihood accounting frauds. Similarly, Feng et al. (2011) provide empirical evidence which suggests that powerful CEOs are more likely to dominate the board of directors as well as the chief financial officers so that CEOs may override internal control system. In such situations, the chief financial officers would suffer pressures from CEOs and collude with CEOs to manipulate financial reporting. Later research on earnings management uses dummies to control for CEOs who serve as the chairman of the board or the founder of firms (e.g., Cohen, Hoitash, Krishnamoorthy, & Wright, 2014; Peasnell, Pope, & Young, 2005; Petrou & Procopiou, 2016). Following the above research, this research uses two proxies for the internal power of CEOs: (i) CEOs serve as the chairman of the board of directors (pCHAIRMAN), where pCHAIRMAN equals to one if a CEO serves as the chairman of the board of directors of firms, zero otherwise; and (ii) CEOs serve as the founder or co-founder of the firms (pFOUNDER), where pFOUNDER equals one if a CEO serves as the founder or co-founder of firms, zero otherwise.

3.4. Age

The next aspect PSCORE is the age of CEOs. There is a large amount of literature on the effect of age of CEOs on earnings management. Huang et al. (2012), Serfling (2014) and Yim (2013) find that, compared to younger CEOs, older CEOs are less likely to engage in earnings management. Because prior research does not provide a clear benchmark of how old is young, we follow the existing literature to rank the age of CEOs in each industry-year to define young CEO. We also take into account the horizontal problem of CEOs tenure (e.g., Ali & Zhang, 2015; Dechow & Sloan, 1991; Kalyta, 2009) which suggests that CEOs are more likely to engage in earnings management activities when they are young or their age is close to the retirement age. Taken together, the next factor of PSCORE is the age of CEOs (pAGE), where pAGE equals to one if either (i) the age of a CEO equals to or less than the 25th percentile of industry-year (identified by Datastream level-six) or (ii) the age of CEOs is one year or less close to the retirement age[6], zero otherwise.

In addition to the age of CEOs, existing research recognises that other personal characteristics, such as gender and marital status, may affect earnings management. Previous research indicates that the gender of directors could affect earnings management (Barua, Davidson, Rama, & Thiruvadi, 2010; Francis, Hasan, Park, & Wu, 2015; Kyaw, Olugbode, & Petracci, 2015; Liu, Wei, & Xie, 2014). Generally, the studies suggest that female directors are more conservative, therefore they are less likely to engage in earnings management activities. Another personal characteristic of CEOs which may affect earnings management is marital status. Hilary, Huang, and Xu (2016) provide evidence that firms having married CEOs exhibit lower earnings management compared with firms having single CEOs. Compared with single CEOs, married CEOs are less likely to engage in earnings management activities because they are more risk averse, which might result from CEOs' preferences to job securities or commitments to family and social relationships (Hilary et al., 2016), or from having less testosterone (Burnham et al., 2003) which is a factor of risk taking behaviours (Jia, Lent, & Zeng, 2014). Regardless of the above evidence, we do not include gender and marital status in PSCORE because of several

[6] The retirement age of men and women in the UK are 65 and 60, respectively, for the period from 1948 to 2010; and from April 2010 to March 2020 the retirement age of women increases one month every month until it reaches 65 (Bozio, Crawford, & Tetlow, 2010).

reasons. First, PSCORE already has a variable for age, which is an observable summary statistic which can be used to characterize the market equilibrium for CEOs with varying personal traits such as effort, risk aversion, expected tenure and human capital (Joos et al., 2003). Second, our sample shows that only 81 out of 3,396 firm-year observations (2.39%) have female CEOs, which is similar to previous studies on board of directors in the UK (e.g., Nguyen, Iqbal, & Shiwakoti, 2015a). Given that there is less gender diversity among CEOs, including the gender in PSCORE may introduce bias. Third, regarding to the marital status, we do not have sufficient data for all CEOs in the sample, therefore including the marital status in PSCORE substantially reduces our sample.

3.5. The composite PSCORE

As explained earlier, PSCORE is a composite score which aggregate nine aspects of the characteristics of CEOs. PSCORE of a CEO who works for firm *i* in year *t* is calculated as follows:

$$PSCORE_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pPRESS_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t} \qquad (1)$$

Since PSCORE is developed in the way that PSCORE value is added one if prior research shows that an individual factor could suggest the presence of earnings management, PSCORE value theoretically ranges from zero to nine, with higher PSCORE suggests higher magnitude of earnings management.

4. VALIDITY TESTS OF PSCORE

4.1. Sample selection

We begin with all firms listed on London Stock Exchange from 2005 to 2012. The sample starts from 2005 for an important reason. Listed companies in the UK have used International Financial Reporting Standards (IFRS hereafter) since 1st Jan 2005, thus the sample avoids the potential effects of the IFRS adoption on financial statement quality in general and on earnings management in particular. The sample includes only live stocks as at 31st December 2012. While the survivorship bias may exist, we omit dead stocks because our research requires large data of CEOs and corporate governance which may not be available for delisted firms. Financial statements and International Securities Identification Number (ISIN hereafter) are downloaded from Datastream. We exclude banks, insurance companies, financial services and utility firms. Firms with negative market values or negative book values of equity are also deleted. Following

Gore, Pope, and Singh (2007), we remove companies with the length of a fiscal year less than 350 days or more than 380 days. To calculate accrual and real earnings management, we run cross-sectional regressions with at least 10 observations in each industry.

To calculate FSD_SCORE, we firstly replace missing values by zeros[7]. Because the research studies the first digits from one to nine, replacing missing values with zeros has no effect on our analysis. The next step is to extract the first digits of all items in balance sheets, income statements and cash flow statements. Similar to Amiram et al. (2015), this research takes the first digit after the negative sign if a number is negative, and take the first non-zero digit if a number has an absolute value less than one. Total first digits for each company in each year are counted. Finally, following Amiram et al. (2015), we exclude observations with fewer than 50 first digits (or 50 figures in financial statements) in total to avoid measurement errors[8] because those firms might be too young or not in continuing operations, therefore including those firms may reduce the statistical meaning of findings[9]. As a result, we derive at 5,110 firm-year observations from 2005 to 2012 (717 unique firms) with 389,619 first digits. This sample is used to calculate FSD_SCORE for firm-year observations and for the whole market to determine if financial statement data of listed companies in the UK conform to Benford's Law.

Next, we construct CEO data. In the first stage, we use ISIN code to search the company in Bloomberg database, then we identify the CEO position for each company in each year. If we do not find the CEO position in a specific year in Bloomberg, we download annual reports from Key Note to find the CEO under the role-description section or based on signatures (with role description) on CEO reports and financial statements. Managing directors or executive chairmen may play the role of CEOs. If there is an appointment of a new CEO in a specific year, we select the new CEO because the latest CEO is the person who would have higher influence on financial statements which are prepared after year end. Companies with missing CEO or with joint-CEOs are deleted. In the second stage, we search for the biographies of CEOs in Bloomberg. If Bloomberg does not provide the biography for any CEO, we search in Key Note platform using

[7] *This approach is used only for the calculation of FSD_SCORE, not for the other datasets.*

[8] *In their paper, Amiram et al. (2015) exclude observations with fewer than 100 digits. Compared with the rule-based principle of US GAAP, the principle-based accounting standards of IFRS in the UK may require less details in presentation of financial statements. Therefore, it is reasonable to expect that, on average, the number of items in IFRS-based financial statements (balance sheets, income statements and cash flows) is less than those in US GAAP-based financial statements. Excluding observations with fewer than 100 substantially reduces our sample size, potentially reduce the power of our tests.*

[9] *However, as a robustness test (not tabulated), including observations with fewer than 50 first digits does not qualitatively change our results.*

the CEO's name and ISIN code. If there is no biography of any CEO after the above procedures, we read the annual reports downloaded from Key Note to search for CEO information in the role description section. Then we search in Financial Times and Linkedin for missing biographies. Finally, if we cannot find sufficient information for the calculation of PSCORE, we delete corresponding observations. Regarding to the data of press coverage, we follow the procedure stated in the section 3.2. We count all the number of newspapers in the search result.

To collect data of corporate governance for control variables, we proceed as follows. The information of external auditors, boards of directors and audit committees is collected from Bloomberg. Missing information is read from Key Note. We also search for information in annual report. Observations with missing data are removed.

Finally, we match financial statement data, CEO data and corporate governance data together, based on the ISIN code and fiscal year. We derive at 3,396 firm-year observations (615 unique companies) in 48 industries (Datastream level-six) with sufficient data to study PSCORE with discretionary accruals. Subsamples to study PSCORE with abnormal cash flows, abnormal production costs, abnormal discretionary expenditures, and FSD_SCORE are 3,139; 3,014; 2,650; and 2,810 [10] firm-year observations respectively. To mitigate the influence of outliers, all continuous variables in the samples are winsorized at the 1st and 99th percentiles.

4.2. Empirical measures of earnings management

4.2.1. Accrual earnings management

The existing literature documents competing models detecting accrual earnings management (Bernard & Skinner, 1996; Dechow et al., 1995; Fields et al., 2001; Guay, Kothari, & Watts, 1996; McNichols, 2000; Peasnell et al., 2000b; Thomas & Zhang, 2000; Young, 1999). Peasnell et al. (2000b) shows that no other model outperforms the modified-Jones model (Dechow et al., 1995; Jones, 1991) in the UK. In the paper, we employ the cross-sectional modified-Jones model to estimate discretionary accruals, where accruals are total accrual[11] and working capital

[10] The subsamples are smaller than the main sample because of two reasons. Firstly, compared with accrual-based models, models used to estimate real earnings management require different figures. Second, the sample used to calculate FSD_SCORE already excludes firms with fewer than 50 items (or 50 first digits) in financial statements.
The resulting sample of 2,840 firm-year observations is less than the main sample of 3,433 firm-year observations because firms with fewer than 50 first digits are excluded in the sample used to construct the proxy for earnings management based on Benford's Law.
[11] Total accruals equal to net income before extraordinary items minus net cash flows from operations.

accrual[12] (use as substitutes). We also employ the margin model of Peasnell et al. (2000b) to estimate discretionary working capital accruals because the margin model is found to be effective in detecting earnings management in the UK. In general, we have three alternative models to estimate discretionary accruals.

4.2.2. Real earnings management

With regard to real earnings management, we apply models of Roychowdhury (2006) to estimate abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures. Roychowdhury (2006) argues that managers may manipulate earnings through real business transactions such as providing increased price discounts or more lenient credit terms, overproduction, or reduction in discretionary expenditures. The above activities lead to abnormally low cash flows from operations, abnormally high production costs, and abnormally low discretionary expenses. Later research shows that the models of Roychowdhury (2006) are able to detect abnormal cash flows, abnormal production costs and abnormal discretionary expenditures (Athanasakou et al., 2011; Athanasakou et al., 2009; Cohen et al., 2008; Cohen & Zarowin, 2010; Gunny, 2010; Zang, 2012). In addition, we construct a variable for total real earnings management because companies may use any of three types of real earnings management. Total real earnings management equals to abnormal production costs minus abnormal cash flows minus abnormal discretionary expenditures.

As PSCORE is expected to capture the presence of earnings management regardless of directions, we follow prior research (e.g., Armstrong et al., 2013; Bergstresser & Philippon, 2006; Hilary et al., 2016; Jiang et al., 2010) to use absolute values of earnings management. The rationale of using absolute values is that earnings management all is about transferring earnings from one year to another year, therefore the total amount of earnings being transferred matters rather than whether that amount negatively or positively affect reported earnings in a specific period (Bergstresser & Philippon, 2006).

4.2.3. The deviations of the first digits from Benford's Law

In addition to the proxies of accrual and real earnings management, we closely follow Amiram et al. (2015) to calculate FSD_SCORE which captures the deviations of the first digits of figures

[12] *Working capital accrual is calculated as follows:* $WAC_{i,t} = (\Delta CA_{i,t} - \Delta CHE_{i,t}) - (\Delta CL_{i,t} - \Delta STD_{i,t})$*; Where* $WAC_{i,t}$ *is working capital accrual,* $\Delta CA_{i,t}$ *is change in current assets,* $\Delta CHE_{i,t}$ *is change in cash and cash equivalents,* $\Delta CL_{i,t}$ *is change in current liabilities,* $\Delta STD_{i,t}$ *is change in short-term debts.*

reported in financial statements from what are expected from Benford's Law. We use FSD_SCORE as the third proxy of earnings management. In the next sections, we briefly overview the application of Benford's Law in accounting research and the calculation of FSD_SCORE.

4.2.3.1. The application of Benford's Law in accounting research

Benford's Law refers to the distributional probability of the digits of numbers in a dataset which was discovered by astronomer Simon Newcomb in 1881 and was later tested on various datasets by physicist Frank Benford, therefore it is commonly known as Benford's Law (Amiram et al., 2015). Benford's Law is applied in many fields to examine whether there are errors in datasets (Amiram et al., 2015; Nigrini, 1996).

A prevalent application of Benford's Law is to assess financial statement errors. Nigrini (1994) indicates that non-conformity to Benford's Law may be a red flag of suspicious data. From the practice perspective, Nigrini and Mittermaier (1997) propose that comparing actual and expected frequencies of a list of numbers can be used as an analytical procedure in an audit. Durtschi, Hillison, and Pacini (2004) also provide the guidance for auditors to apply Benford's Law to detect suspected accounts which may contain frauds.

A number of authors use Benford's Law to assess earnings management. Studying interest received and interest paid on individual tax returns, Nigrini (1996) reports that interest received has higher (lower) than expected frequencies of smaller (larger) first digits. In contrast, interest paid has lower (higher) than expected frequencies of smaller (larger) first digits. The findings suggest that interest received (paid) has been understated (overstated), resulting from the tax evasion behaviour of taxpayers. Carslaw (1988) studies the second digits of reported income in financial statements of New Zealand firms and find that the actual frequencies of zeros (nines) is more (less) than expected by Benford's Law. He interprets that this phenomenon is caused by the rounding up behaviour of managers to achieve earnings targets. For example, when the true earnings are 5,984 (or any number just below 6,000), managers are more likely to report the earnings of 6,004 (or any number just above 6,000) to meet or beat the earnings target of 6,000. Consequently, the frequency of the second digit zeros is abnormally higher than expected, while the frequency of the second digit nines is abnormally low. Consistent with Carslaw (1988), Thomas (1989) shows similar patterns in the US, but there are less deviations of earnings numbers from expectations following Benford's Law. Thomas (1989) also reports that while loss firms have more second digit nines and fewer second digit zeros than expected, profit firms have abnormally high frequencies of zeros and fives in the second digits after the decimal points of earnings per share (EPS) numbers. Nevertheless, both Carslaw (1988) and Thomas (1989) focus on earnings numbers of firms in many years rather than using firm-year data.

In the line with the above research, Amiram et al. (2015) show that figures reported in financial statements of US listed companies from 2001 to 2011 follow Benford's Law. They also develop an innovative score, namely FSD_SCORE, to capture the deviations of the first digits of figures reported in financial statements from Benford's Law. FSD_SCORE is defined as the sum of the deviations of the first digits from Benford's Law divided by nine, where deviations are absolute differences between observed (actual) frequencies of the first digits and expected frequencies of all items in balance sheets, income statements, and cash flow statements. Amiram et al. (2015) mathematically prove that an introduction of errors to financial statements results in more divergence from Benford's Law of the first digits. FSD_SCORE is also found to be correlated with earnings management and is helpful to predict material accounting misstatements identified by AAER.

It is worthy to note that the term "errors" used in the paper of Amiram et al. (2015) (and in this research) has a slightly different meaning from what defined by auditing standards (e.g., International Auditing and Assurance Standards Board, 2010) in which errors result from unintentional acts, leading to misstatements of financial statements. From the auditing standard perspective, accounting misstatements include errors (unintentional) and frauds (intentional). In this research, the term "errors" refers to irregularities of accounting data regardless whether they result from intentional or unintentional acts. In other words, the term "errors" used in Amiram (2015) paper has a close meaning to "misstatements" used in the auditing standards.

4.2.3.2. The calculation of FSD_SCORE

To capture the deviations of the first digits of numbers in financial statements from Benford's Law, FSD_SCORE is calculated based on the Mean Absolute Deviation (MAD) (Amiram et al., 2015). The use of MAD statistic overcomes a major drawback of another approach, which is the Kolmogorov–Smirnov (KS) statistic[13]. When the population of the first digits are large,

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[13] *Unlike the MAD, KS statistic uses maximum deviations from Benford's Law, where deviations are defined as cumulative differences between observed and expected probabilities of the first digits. The critical value to test whether a firm conforms to Benford's Law at the 5% significant level is* $1.36\sqrt{P}$*, where P is total number of the first digits (Amiram 2015).*

compared with KS statistic, MAD statistic is more appropriate in comparing financial statements across firms, industries and times (Amiram et al., 2015). $FSD\_SCORE_{i,t}$ is calculated as follows:

$$FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9}\left|OBSERVED_{d,i,t} - EXPECTED_{d}\right|}{9} \qquad (2)$$

Where: $FSD\_SCORE_{i,t}$ is the mean absolute deviation of the first digits of figures reported in financial statements from what are expected by Benford's Law of firm i in year t; $OBSERVED_{d,i,t}$ is the observed (actual) probability of the first digit d of firm i in year t; $EXPECTED_{d}$ is the expected probability of the first digit d as defined by Benford's Law; and d = 1, 2, …, 9.

When financial statements are free of errors, FSD_SCORE equals to zero because financial statements follow Benford's Law (Amiram et al., 2015). An introduction of errors to financial statements increases the deviations of the first digits, therefore FSD_SCORE can be used as a proxy of earnings management.

4.3. Control variables

In the main test, we examine if PSCORE is positively correlated with the established measures of earnings management. To differentiate the effect of other factors on earnings management, we use a set of control variables which have been shown in literature as important determinants of earnings management. Before proceeding to the control variables, we briefly introduce how industry-adjusted values are estimated.

Industry-adjusted values

For control variables which are not dummies, the paper uses the industry-adjusted values because the measures of accrual and real earnings management are calculated from industry-year. Industry-adjusted values equal to actual values minus corresponding industry-year mean as follows:

$$aX_{i,t} = X_{i,t} - \bar{X}_{t,k} \quad (3)$$

Where: $aX_{i,t}$ is industry-adjusted values of control variable $X_{i,t}$ of firm i in year t[14]. $\bar{X}_{t,k}$ is the mean of corresponding industry k in year t (k is Datastream level-six industry numbers).

[14] *A lower case "a" means that control variable $X_{i,t}$ is already adjusted for corresponding industry-year mean.*

Equity issuance

Firstly, the paper controls for equity issuances. In capital markets, investors and financial analysts use accounting numbers for pricing equity instruments such as shares, therefore managers have incentives to manipulate earnings before equity issuance. Prior research provides evidence that earnings are managed before equity offering (Aharony, Lin, & Loeb, 1993; DuCharme, Malatesta, & Sefcik, 2001; Iqbal, Espenlaub, & Strong, 2009; Iqbal & Strong, 2010; Kao, Wu, & Yang, 2009; Kim & Park, 2005; Teoh, Welch, & Wong, 1998a; Teoh, Welch, & Wong, 1998b) or before share-financed mergers and acquisitions when stocks are used as a part of the payment method (Agrawal, Jaffe, & Mandelker, 1992; Botsari & Meeks, 2008; DeAngelo, 1986; Erickson & Wang, 1999; Loughran & Vijh, 1997). We control for the effect of seasoned equity offerings and share-financed mergers and acquisitions. The first dummy is *SEO* which equals to one if firm *i* issues a significant portion of equity in year *t* (outstanding shares increase at least 5% and proceeds from equity issuance are positive[15]), zero otherwise. The next dummy is *M&A* which equals to one if firm *i* announces a share-financed merger and acquisition deal in year *t*, zero otherwise. We expect that the coefficients of both *SEO* and *M&A* are positive.

Corporate governance factors

The second group of determinants of earnings management are corporate governance factors. Firstly, the board of directors play an important role in monitoring managers by reviewing and approving financial reports prepared by CEOs (see, e.g., Financial Reporting Council, 2003, 2012). The board also involves in appointing or firing CEOs as well as setting CEOs' compensation[16]. From the monitoring perspective of the board, independent directors significantly contribute to higher quality of monitoring activities. Empirical research provides evidence that earnings management is negatively affected by board independence (Davidson, Goodwin-Stewart, & Kent, 2005; Iqbal & Strong, 2010; Klein, 2002; Peasnell et al., 2005; Xie et al., 2003). To control for the board independence, this paper uses the variable *aBDIND* which is the industry-adjusted board independence, where board independence is the percentage of independent directors in a board. We expect that the coefficient of a*BDIND* is negative.

Secondly, the audit committee oversees the effectiveness of internal control, the integrity of financial statements, and the work performed by external auditors (see, e.g., Financial Reporting Council, 2003, 2012), therefore it might constrain earnings management. Empirical evidence

[15] 5% benchmark is used to ensure the share issuance is significant enough for earnings management.

[16] The board may directly or indirectly involve in such activities through its sub-committees such as compensation and nomination committees.

shows that the independence of audit committee is negatively affect earnings management (Bédard et al., 2004; Chtourou, Bedard, & Courteau, 2001; Klein, 2002; Vafeas, 2005). Following the previous research, we control for the independence of audit committee by using the variable *aACIND* which is the industry-adjusted audit committee independence, where audit committee independence is the percentage of independent members in an audit committee. We expect that the coefficient of *aACIND* is negative.

Thirdly, external auditors are also important gatekeepers to constrain earnings management. Prior research finds that earnings management is negatively impacted by the audit quality (Balsam, Krishnan, & Yang, 2003; Becker, Defond, Jiambalvo, & Subramanyam, 1998; Kim, Chung, & Firth, 2003; Krishnan, 2003). Krishnan (2003) shows that firms having auditors with high expertise exhibit less discretionary accruals than firms having auditors with low expertise. Similarly, Becker et al. (1998) shows that, compared with clients of non-Big Six auditors, clients of Big Six auditors display lower discretionary accruals. Later research (Iatridis, 2012; Peasnell, Pope, & Young, 2000a; Peasnell et al., 2005) uses a dummy variable to control for the effect of Big audit firms[17] on earnings management. In the line with prior research, to control for the effect of external auditor on earnings management, the paper uses the dummy variable *AUDIT* which equals to one if firm *i* in year *t* is audited by a Big Four audit firm[18], zero otherwise. We expect that the coefficient of *AUDIT* is negative.

Firm characteristics

The next group of control variables are firm characteristics. We firstly control for financial distress of firms by calculating ZSCORE following Taffler (1983). Taffler (1983) and Agarwal and Taffler (2007) indicate that the probability of bankruptcy is highly associated with a negative ZSCORE. When the ZSCORE is low, firms are likely to face financial distress. Therefore, they might have pressure to manage earnings to conceal poor financial performance. Previous studies (Lara, Osma, & Neophytou, 2009) show that firms inflate earnings when facing financial distress. The paper uses the dummy variable *DISTRESS* which equals to one if ZSCORE of firm

[17] *The definitions of a big audit firm vary from study to study due to sample used in each research. The audit market experienced several major waves of mergers and acquisitions since 1990, therefore prior research may use Big Four, Big Five, Big Six, or even Big Eight.*

[18] *Big Four audit companies are KPGM, Ernst and Young, Deloitte Touche Tohmatsu and PriceWaterhouseCoopers. Missing data are replaced by zeros as the paper assumes that the firm are audited by non-Big Four auditors.*

i in year *t-1* is negative, zero otherwise; where ZSCORE is estimated as explained in Taffler (1983)[19]. We expect that the coefficient of *DISTRESS* is positive.

Business life cycle is another factor influencing earnings management. Beneish (1997) presents evidence that, in order to raise money from the capital market for the first time, young listed firms engage in earnings management to meet the expectation of the market. Lee, Li, and Yue (2006) find that firms having higher performance or expected growth overstate earnings as a result of an increase in price responsiveness. Follows Dickinson (2011), the paper controls for the business life cycle of firms by using the dummy variable *CYCLE* which equals to one if a firm has all negative cash flows from operating, investing and financing activities (young firm) in year *t*, or has negative cash flows from operating activities and positive cash flows from both investing and financing activities (growth firm) in year *t*, zero otherwise. We expect that the coefficient of *CYCLE* is positive.

The next control variable is firm size. Lang and Lundholm (1993) propose that, due to high scrutiny, lagers firms are reluctant to manipulate earnings. Dechow and Dichev (2002) report a negative relationship between firm size and earnings management. Following prior research (e.g., Peasnell et al., 2000a), we control for firm size by using the natural log of market value of equity. The next control variable is *aLOGMVE* which is the industry-adjusted firm size, where firm size *(LOGMVE)* equals to natural log of the market value of equity of firm *i* at the end of fiscal year *t-1*. We expect that the coefficient of *aLOGMVE* is negative.

The literature also documents that market overvaluation is a determinant of earnings management. Firms with overvalued shares have incentives to inflate earnings to maintain high market value (Jensen, 2005). Empirical evidence supports the notion that overvaluation is positively associated with income-increasing earnings management (Chi & Gupta, 2009; Houmes & Skantz, 2010). To control for overvaluation, we use the variable *aLOGMTB* which is the industry-adjusted market-to-book ratio, where the market-to-book ratio *(LOGMTB)* is defined as the natural log of the ratio of market value divided by book value of equity of firm *i* at the end of fiscal year *t-1*. We expect that the coefficient of *aLOGMTB* is positive.

The next characteristic which needs to be controlled for is financial leverage. On one hand, Press and Weintrop (1990) find that debt levels are positively correlated with accruals. Lenders

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[19] *Calculation of ZSCORE following Taffler (1983) is as follows:* $ZSCORE = 3.2 + 12.18 * X_1 + 2.50 * X_2 - 10.68 * X_3 + 0.029 * X_4$; *where* $X_1 = \frac{Profit\ before\ tax}{current\ liabilities}$; $X_2 = \frac{Current\ assets}{Total\ liabilities}$; $X_3 = \frac{Current\ liabilities}{Total\ assets}$; $X_4 = \frac{(Quick\ assets - Current\ liabilities)}{(Sales - Pretax\ income - Depreciation)/365}$

normally include debt covenants, which are mainly calculated from financial statements, in lending contracts. Previous research (DeFond & Jiambalvo, 1994; Sweeney, 1994) shows that earnings is inflated to avoid violating debt covenants. On the other hand, high financial leverage may contractually lead to conservative accounting (Watts, 2003a, 2003b), suggesting less positive discretionary accruals. Empirical evidence shows that financial leverage is negatively correlated with earnings management (Pae, 2007). Similar to prior research (Peasnell et al., 2000a; Peasnell et al., 2005), we control for financial leverage by using variable *aLEV* which equals to the sum of long-term debts and short-term debts of firm *i* at the end of fiscal year *t-1* divided by total assets at the end of fiscal year *t-1*. We do not expect the sign of the coefficient of variable *aLEV* because the findings of prior research are mixed.

Lastly, the literature documents that earnings management is affected by ability to use accruals in current period. Under the accrual basis accounting, accruals are reversed in the later periods. Overstatement of net operating assets, as a result of inflating earnings in prior periods, would limit the ability to use accruals in later periods (Barton & Simko, 2002). Baber, Kang, and Li (2011) argue that the magnitude and reversal speed of discretionary accruals in later periods affect the ability to manage earnings. To deal with this issue, we use the variable *aNOA* which is the industry-adjusted net operating asset ratio[20] of firm *i* at the end of year *t-1*. We expect that the coefficient of *aNOA* is negative.

Multivariate regression models

Firstly, to study how PSCORE is correlated with accruals earnings management, we use the following set of regressions:

$$\begin{aligned} EM_{i,t} = {} & \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} \\ & + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} \\ & + \beta_{10} aLOGMTB_{i,t-1} + 11 aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon, \qquad (3) \end{aligned}$$

where $EM_{i,t}$ are the absolute values of discretionary total accruals ($absDAC_{i,t}$) and discretionary working capital accruals ($absDWAC_{i,t}$) both estimated by the modified-Jones models (Dechow et al., 1995; Jones, 1991), and discretionary working capital accruals ($absDAMP_{i,t}$) estimated by

[20] *Net operating asset ratio is calculated as follows:* $NOA = [CEQ + (DLTT + DLC) - CHE]/REV$, *where:* CEQ *is total book value of equity;* $DLTT$ *is long-term debts;* DLC *is short term debts;* CHE *is cash and cash equivalent, all measured at the end of fiscal year t-1;* REV *is sales in year t-1.*

the margin model (Peasnell et al., 2000b). Accruals earnings management are used as substitutes in the regressions.

Secondly, to study how PSCORE is correlated with real earnings management, we use the following set of regressions:

$$RM_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon \quad (4)$$

where $RM_{i,t}$ are the absolute values of abnormal cash flows ($absDCF_{i,t}$), abnormal production costs ($absDPROD_{i,t}$), and abnormal discretionary expenditures ($absDDISEXP_{i,t}$) estimated by the models of Roychowdhury (2006), and total real earnings management ($absREM_{i,t}$). The proxies of real earnings management are used as substitutes in the regressions. The models do not have control variables $AUDIT_{i,t}$ and $aNOA_{i,t-1}$ because prior research suggests that external auditor does not constrain earnings management (see, e.g., Cohen et al., 2008; Zang, 2012) and that overstatement of net operating assets in prior periods would limit the ability manipulate accruals (not real activities) in later periods (see, e.g., Baber et al., 2011; Barton & Simko, 2002).

Thirdly, to study how PSCORE is correlated with FSD_SCORE, we use the following set of regressions:

$$FSD\_SCORE_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + YEAR/INDUSTRY\ FIXED\ EFFECTS + \varepsilon \quad (5)$$

If the coefficients $\hat{\beta}_1$ in the above regressions are positive and significant, this is evidence that PSCORE is able to signal the presence of earnings management.

4.4. Findings

4.4.1. Descriptive statistics and correlations

Table 1 reports the descriptive statistics of firm characteristics, individual factors of PSCORE, proxies of earnings management, and control variables in main regressions. At the first glance, the numbers of observations of real earnings management and FSD_SCORE are smaller than those of accruals earnings management because, as discussed previously, the proxies of real earnings management require different figures and FSD_SCORE requires firms with more than 50 items (or first digits) reported in financial statements. Looking at Panel A, the descriptive statistics of firm's characteristics in the main sample are broadly similar to those reported by Nguyen et al. (2015a) and Goh and Gupta (2016) which use similar data. The descriptive statistics on individual factors of PSCORE reported in Panel B show that, on average, CEOs have low financial expertise (medians of all proxies for financial expertise are 1) and high reputation (medians of *pPRESS*, *pROA* and *pEARLY* are 1, 0 and 0, respectively). The statistics also indicate that fewer CEOs are chairman or founder of firms (medians of *pCHAIRMAN* and *pFOUNDER* are 0). Turning to Panel C, among the proxies of accrual earnings management, we observe that the values of *absDAC* are the highest in all aspects (mean, standard deviation, median, 25 and 75 percentiles), and the values of *absDAMP* are the lowest. The findings are supported by previous studies since Botsari and Meeks (2008) find that the approach using total accruals has tendency to result in larger discretionary accruals than the approach using working capital accruals and Peasnell et al. (2000b) provide evidence the Jones and modified-Jones models produce higher discretionary accruals than those estimated by the margin model when cash flows are unusually high. We also observe that the mean and standard deviation of FSD_SCORE of listed companies in the UK from 2005 to 2012 are 0.0324 and 0.0098 respectively, which are similar to those of listed companies in the US reported by Amiram et al. (2015)[21]. In Panel D, the mean and median of PSCORE are 3.8065 and 4 respectively, suggesting that the difference in the number of firms having CEOs with high PSCORE and firms having CEOs with low PSCORE is not large, given that PSCORE empirically ranges from zero to eight[22]. Panel D also displays that the sample has more firms without equity issuance than firms with equity issuance (all medians of SEO and M&A are 0), has more firms audited by Big Four than firms not audited by Big Four (median of AUDIT is 1), has more firms not facing financial distress than firms facing financial distress (median of DISTRESS is 0), and has more mature firms than young or growth firms (median of CYCLE is 0).

[*INSERT TABLE* 1 *ABOUT HERE*]

Table 2 reports FSD_SCORE and related statistics for the whole market in the research period. The aggregate FSD_SCORE for the whole market of listed companies in UK from 2005 to 2012

[21] Amiram et al. (2015) report that the mean and the standard deviation of FSD_SCORE of listed companies in the US from 2001 to 2011 are 0.0296 and 0.0087, respectively.

[22] While PSCORE theoretically varies from zero to nine, there is no CEO with a PSCORE of nine in the sample.

is 0.0011 which is also similar to that of companies listed in US reported by Amiram et al. (2015)[23].

$[INSERT\ TABLE\ 2\ ABOUT\ HERE]$

Table 3, which reports Pearson correlations, indicates that all correlations between PSCORE and earnings management proxies are positive and significant at 1% level, suggesting positive relationships between PSCORE and earnings management. While there are many insignificant correlations among independent variables, we still test for multicollinearity between independent variables using variance inflation factors (VIFs) obtained from the ordinary least squares regressions. The results (not tabulated) indicates that all VIFs are less than 2.47 which is well below 10, the indicative level of multicollinearity suggested by Neter, Kutner, Nachtsheim, and Wasserman (1996).

$[INSERT\ TABLE\ 3\ ABOUT\ HERE]$

4.4.2. Principal component analysis

A potential issue with the aggregate approach to construct PSCORE is that individual factors may be auto-correlated. To deal with this issue, we employ principal component analysis. In Table 4, Panel A shows that most correlation coefficients are very small (absolute values are less than 0.15), except for the correlations between pCERT and pCFO (0.4822) and between pEARLY and pROLE (0.5159). Many correlations are statistically insignificant. In addition, while Panel B indicates that the proportion of variances explained by an individual component ranges from 4.94% to 17.86%, Panel C displays that no individual factor has too high loading. In summary, the principal component analysis suggests that no individual factor dominates other factors in explaining the variances of PSCORE.

[INSERT TABLE 4 ABOUT HERE]

4.4.3. Univariate tests

The univariate tests study how earnings management variables change when PSCORE changes. Table 5 reports the means of earnings management proxies by each PSCORE. It can be seen that the mean values increase when PSCORE increases. Additionally, the last four rows of Table 5 report results of the t-test under the null that the means of earnings management proxies of high-PSCORE group (PSCORE equals to 6, 7 and 8) is the same as those of low-PSCORE group

[23] Amiram et al. (2015) report that the aggregate FSD_SCORE of listed companies in US from 2001 to 2011 is 0.0009.

(PSCORE equals to 0, 1, and 2). The findings demonstrate that, compared to the low-PSCORE group, the high-PSCORE group exhibit higher earnings management. The mean differences of earnings management between two groups are statistically significant at 1% level[24]. In general, the findings suggest that PSCORE is positively correlated with earnings management.

$[INSERT\ TABLE\ 5\ BOUT\ HERE]$

4.4.4. Multivariate tests

This section reports the findings of the main regressions. Table 6 presents results of the set of regressions (3). It can be seen that control variables have predicted signs and most coefficients are persistently significant across different models. As expected, the positive coefficients SEO and M&A suggest that equity issuance negatively affect earnings management. The effects are statistically significant (p-values < 0.01) and economic significant. In addition, it can be seen that coefficients of AUDIT, aBDIND, and aACIND are negative, implying that strong corporate governance constrain earnings management. Particularly, the negative effect of AUDIT on earnings management is consistently significant (p-value < 0.01) across different models. Turning to the main variable of interests of PSCORE, consistent with prediction, we find positive coefficients of PSCORE. The positive relationships are statistically significant in all models where dependent variables are absDAC, absDWAC, and absDAMP (p-values < 0.05). While the PSCORE coefficients are slightly different among the models, the qualitative effects are consistent. In terms of economic significant, the coefficient of absDAC suggests that one unit increase in PSCORE leads to an increase in discretionary total accruals of 0.31% of opening total assets, even after controlling for equity offering, corporate governance factors, and firm characteristics. Given that the means of total assets and earnings before extraordinary items of firms in the sample are £990.1 million and £66.3 million (reported in Table 1), the marginal effect of PSCORE on discretionary total accruals is equivalent to nearly 4.63% (=990.1*0.31%/66.3) of net income before extraordinary items, which is significant in economic terms. Similarly, an increase in PSCORE by one unit results in an increase in discretionary working capital estimated by the modified-Jones models and the margin model about 0.21% and 0.31% of opening total assets, equivalent to 3.13% and 4.63% of net income before extraordinary

[24] *As a robustness test (not tabulated), we also define PSCORE groups in another way where the low-PSCORE group includes PSCORE ranging from 1 to 4 and the high-PSCORE group includes PSCORE ranging from 5 to 8. The findings do not qualitatively change.*

items, respectively. In general, the findings provide evidence for the validity of PSCORE in signalling the presence of accrual earnings management.

[INSERT TABLE 6 ABOUT HERE]

Moving on now to consider real earnings management, Table 7 shows the results of the set of regressions (4). Most of control variables are consistently significant across different models and have the expected signs. As predicted, we document positive coefficients of the established proxies of real earnings management. The correlations between PSCORE and real earnings management are statistically significant (p-values < 0.05). The correlation between PSCORE and *absREM* is also statistically significant. In terms of economic significance, when PSCORE increases by one unit, the increases in *absDCF*, *absDPROD* and *absDDISEXP* are about 1.18%, 0.47%, and 0.62% of opening total assets (equivalent to 17.62%, 7.02% and 9.26% of net income before extraordinary items), respectively. We observe that the marginal effects of PSCORE on real earnings management are significantly higher than on accrual earnings management. The reason might be that, the CEOs of firms in the research period (from 2005 to 2012) might prefer real earnings management than accrual earnings management as a result of strong regulations after the passage of Sarbanes-Oxley Act (2002) (see, e.g., Cohen et al., 2008). In summary, the results support the notion that PSCORE is positively correlated with the established proxies of real earnings management.

[INSERT TABLE 7 ABOUT HERE]

Regarding to the deviations of the first digits of figures reported in financial statements from what are expected by Benford's Law, Table 8 reports the findings from the set of regressions (5). Most coefficients of control variables are significant and have signs consistent with predictions. The findings show that the coefficients of PSCORE in all four models (pooled regressions with fixed effects, year-fixed effects, industry-fixed effects, and industry-year fixed effects) are positive and consistently significant (p-values < 0.05). The marginal effect of PSCORE on FSD_SCORE in the regression with industry-year fixed effects is 0.0003, which accounts for 0.93% of FSD_SCORE given that the mean of FSD_SCORE for the firms in the sample is 0.0324 (reported in Table 1). In general, the results demonstrate that PSCORE is able to capture the deviations of the first digits of figures reported in financial statements from what are expected by Benford's Law.

[INSERT TABLE 8 ABOUT HERE]

To summarize, the findings of the multivariate regressions indicate that PSCORE is positively correlated with the established proxies of earnings management. All correlations are statistically significant at 5%. The results are robust across different models as we measure accrual and real earnings management in different ways and we use various models to control for firm-year fixed effects. The findings suggest that PSCORE can be used as an effective tool to signal the presence of earnings management.

4.4.5. Robustness tests

Firstly, as discussed previously, we use discretionary total accruals and discretionary working capital accruals estimated by the modified-Jones model (Dechow et al., 1995; Jones, 1991) and discretionary working capital accruals estimated by the margin model (Peasnell et al., 2000b). The findings are robust because the correlations between PSCORE and discretionary accruals are statistically significant in all regressions.

Secondly, we construct PSCORE in different ways. We use different possible definitions for some factors such as pROA and pAGE. We transform pROA into pROA1, pROA2 and pROA3, in which return on assets are calculated differently. For pROA1, return on assets equals to net income before extraordinary items divided by the market values of equity. For pROA2, return on assets equals to after tax net income divided by total assets. For pROA3, return on assets equals to after tax net income divided by the market values of equity. We also change the definition of pAGE. Instead of considering one year prior to retirement age in the calculation of pAGE, we define pAGE1 equals to one if either (i) the age of a CEO equals to or less than the 25^{th} percentile of industry-year (identified by Datastream level-six) or (ii) the age of CEOs is two years or less close to the retirement age, zero otherwise. We construct seven new different PSCOREs by replacing each factor in turn or replacing the combinations of both factors together. The results (not tabulated) do not qualitatively change.

Third, we calculate industry-adjusted FSD_SCORE (aFSD_SCORE) and regress it on PSCORE. In the industry-adjusted model, control variables are also industry-adjusted values rather than firm values. The following equation is used:

$$\begin{aligned} FSD\_SCORE_{i,t} = {} & \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} \\ & + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} \\ & + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon. \end{aligned} \quad (6)$$

The findings for the regression (6) (not tabulated) show that the main conclusions are qualitatively unchanged.

Four, we include joint CEOs in the samples. For companies with joint CEOs, we select the one who potentially has higher influence on financial statements based on three-stage criteria. In the first stage, we select CEO based on CEO status at year end. If joint CEOs both have the CEO status at year end, in the second stage, we select the CEO who works in the company for a longer period of time. If we still cannot select a CEO, in the third stage, we select the CEO with higher salary. As a result, the main sample increases from 3,396 to 3,433 firm-year observations (618 unique companies in 49 industries). The subsamples for studying abnormal cash flows, abnormal production costs, abnormal discretionary expenditures, and FSD_SCORE are 3,174; 3,049; 2,675 and 2840 respectively. The evidence (not tabulated) does not qualitatively change.

In general, robustness tests provide evidence to strengthen our main findings that PSCORE could signal the presence of earnings management.

5. CONCLUSIONS

This research develops a composite score, namely PSCORE, which captures the profile of CEOs and examine if PSCORE could signal the presence of earnings management. Based on prior research, PSCORE aggregate nine aspects of the profile of CEOs. We use the modified-Jones models (Dechow et al., 1995; Jones, 1991) and the margin model (Peasnell et al., 2000b) to estimate accrual earnings management, and the models of Roychowdhury (2006) to estimate real earnings management. We also follow Amiram et al. (2015) to study the distributional probabilities of the first digits of figures reported in financial statements and use the mean absolute deviation of the first digits from Benford's Law as the third proxy of earnings management. Using a sample of 3,396 firm-year observations (615 unique firms) of listed companies in the London Stock Exchange from 2005 to 2012, we find that PSCORE is positively correlated with all established proxies of earnings management. The relationships are statistically significant and robust across different models, different ways to construct PSCORE and different sample selections. The results demonstrate that PSCORE can be used as an effective tool to detect earnings management. The paper contributes to literature and practice in several ways. First, the paper is the first of its kinds which aggregates various characteristics of CEOs to capture earnings management. Second, PSCORE developed in the paper is easy to construct because it mainly requires data collected from the curriculum vitae of CEOs. Third, PSCORE is able to signal the presence of both accrual earnings management. Four, in the contexts of auditing, external auditors could use PSCORE to assess risks of material misstatements at the financial statement level. Boards of directors could use PSCORE to assess the profile of CEOs before making recruiting decisions. Other practitioners such as investors could also use PSCORE to assess the reliability of financial statements.

APPENDIX 1: THE THEORETICAL BACKGROUND UNDERPINNING THE USE OF BENFORD'S LAW TO CAPTURE FINANCIAL STATEMENT ERRORS

Benford's Law refers to distributional probability of the digits of numbers in a dataset. The distributional probability of the first digits was discovered by astronomer Simon Newcomb in 1881 and was later tested on various datasets by physicist Frank Benford, therefore it is commonly known as Benford's Law (Amiram et al., 2015). The expected frequencies of the first digits of numbers in a dataset are following (Amiram et al., 2015, p. 1547) [25]:

First digit	1	2	3	4	5	6	7	8	9
Expected frequency	0.3010	0.1761	0.1249	0.0969	0.0792	0.0670	0.0580	0.0512	0.0458

The intuition why the probability of the first digit one is the largest and the probability of the first digit nine is the smallest is as follows. As explained by Nigrini (1996), the number one needs 100% growth to change to the number two (e.g., the population of a city increases from 100,000 to 200,000 people), the number two needs 50% growth to change to number three (e.g., the population increases from 200,000 to 300,000 people), and so forth, finally the number nine needs only 11.1% growth to change to the number one (e.g., the population increases from 900,000 to 1,000,000 people). Therefore, a number starting with the digit one (nine) has the highest (smallest) probability of existence in a population.

Mathematically, the expected frequency of the first digit of a number following the Benford's Law is given by the equation (Amiram et al., 2015, p. 1547):

$$\mathrm{P(the\ first\ digit\ is\ d)} = \log_{10}(\mathrm{d}+1) - \log_{10}(\mathrm{d})\,; \qquad \text{where } \mathrm{d} = 1, 2, \dots, 9$$

There are two mathematical facts underpinning the Benford's Law (Amiram et al., 2015). Firstly, the mathematical approach to identify the first digit of any number N is to take the base 10 log of N [or $\log_{10}(\mathrm{N})$], then to find the remainder (or mantissa) which is the fraction following the decimal point of an integer (Pimbley, 2014; Smith, 1997). The number N has the first digit d if and only if the mantissa of $\log_{10}(\mathrm{N})$ is between $\log_{10}(\mathrm{d}+1)$ and $\log_{10}(\mathrm{d})$ (where d is 1, 2, …, 9). For example, the number N has the first digit one if and only if the mantissa of $\log_{10}(\mathrm{N})$

[25] *For expected frequencies of the second, third and fourth digits following Benford's Law, please read Nigrini (1996)*

is between $\log_{10}(2) = 0.3010$ and $\log_{10}(1) = 0$. Similarly, the number of N has the first digit two if and only if the mantissa is between $\log_{10}(3) = 0.4771$ and $\log_{10}(2) = 0.3010$, and so forth[26].

Secondly, Amiram et al. (2015) mathematically prove that if the probability distribution function of $\log_{10}(\text{N})$ is smooth and symmetric, the interval between the fractions following the decimal point of $\log_{10}(\text{N})$ are exactly the same as distributional frequencies determined by Benford's Law. Regarding to the example of the number N above, the difference of 0.3010 [$= \log_{10}(2) - \log_{10}(1) = 0.3010 - 0$] is the expected probability of the first digit one as defined by the Benford's Law, the difference of 0.1761 [$= \log_{10}(3) - \log_{10}(2) = 0.4771 - 0.3010$] is the expected probability of the first digit two, and so forth.

An interesting question is whether financial statement numbers conform to Benford's Law when there is a mixture of estimations of cash flow realisations in accounting data[27]. Ray and Lindsay (2005) indicate that a mixture of normal distributions has a nearly exact normal distribution when their means are less than two standard deviations apart, therefore it conforms to Benford's Law. Hill (1995) proves that, under certain conditions, combined distributions follow Benford's Law if there is no error in datasets. While Pimbley (2014) shows that the Central Limit Theorem results in conformity to Benford's Law of datasets if data distributions tend to be smooth and symmetric in nature, Amiram et al. (2015) mathematically prove that the distribution of a mixture of estimations of cash flow realisations tends to be smooth and symmetric and therefore follows Benford's Law. Using a US sample, Amiram et al. (2015) empirically show that the first digits of financial statement data follow Benford's Law at the market level and firm level. Similar to Amiram et al. (2015), we expect and find that the first digits of financial statement data of listed companies in the UK follow Benford's Law.

[26] *Amiram et al. (2015) provide mathematical guidance to determine the first digit of the number 7823.22 as an example. First, calculate* $log_{10}(7823.22)$ *(base 10 log of the original number), which equals 3.893. Second, identify the mantissa behind the integer of the number found in step one, which is 0.893. Third, calculate* $10^{0.893}$ *(power 10 of the mantissa), which equals to 7.81. The integer 7 found in the third step is the first digit of the original number 7823.22.*

[27] *Financial statements are prepared to give information about realisations of all present and future cash flows which are unknown at the time of presentation. There are different cash flows related to financial statements such as cash flows received from revenues, cash flows paid to suppliers, cash flows paid to employees or cash flows paid to tax authorities. It is expected that financial statements may result from a mixture of estimations of cash flow realisations (Amiram et al. 2015).*

APPENDIX 2: VARIABLE DEFINITIONS

Variables	Definitions
Individual factors of PSCORE	
pAGE	equals to one if either (i) the age of a CEO equals to or less than the 25th percentile of industry-year (identified by Datastream level-six) or (ii) the age of CEOs is one year or less close to the retirement age, zero otherwise.
pCERT	equals to one if a CEO does not have a MBA or CPA equivalent, zero otherwise.
pCFO	equals to one if a CEO does not have working experience as a chief financial officer, zero otherwise.
pCHAIRMAN	equals to one if a CEO serves as the chairman of the board of directors of firms, zero otherwise.
pEARLY	equals to one if a CEO is within the first three years of service in the firm, zero otherwise.
pFOUNDER	equals one if a CEO serves as the founder or co-founder of the firm, zero otherwise.
pPRESS	equals to one if the number of newspapers which simultaneously cites the name of a CEO and the company the CEO is working for in a year is less than the corresponding industry mean (identified by Datastream level-six), zero otherwise.
pROA	equals to one if the average of industry-adjusted returns on assets (aveROA) during the last three years of CEO's tenure is negative, zero otherwise; where aveROA is (i) the sum of industry-adjusted returns on assets in year *t*, *t-1* and *t-2* if a CEO is on the third year of tenure, or (ii) the sum of industry-adjusted returns on assets in year *t* and *t-1* if a CEO is on the second year of tenure, or (iii) the industry-adjusted return on assets in year *t* if a

	CEO is on the first year of tenure. Return on assets equals to net income before extraordinary items divided by total assets.
pROLE	equals to one if the number of years a CEO works as a chief executive officer is less than the corresponding industry-year mean (identify by Datastream level-six), zero otherwise.
PSCORE	$= \text{pCFO} + \text{pCERT} + \text{pROLE} + \text{pPRESS} + \text{pROA} + \text{pEARLY} + \text{pFOUNDER} + \text{pCHAIRMAN} + \text{pAGE}$
Proxies of earnings management	
absDCF	Absolute values of abnormal cash flows (DCF). DCF are residuals of the following regression with at least ten observations for each industry-year (Datastream level-six): $\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$; where $CFO_{i,t}$ is net cash flows from operations of firm *i* in year *t;* $A_{i,t-1}$ is total assets of firm *i* at the end of year *t–1;* $REV_{i,t}$ is sales of firm *i* in year *t*; $\Delta REV_{i,t}$ is change in sales of firm *i* from year *t-1* to year *t*.
absDAC	Absolute values of discretionary total accruals (DAC) estimated by the modified-Jones models (Dechow et al., 1995; Jones, 1991) with at least ten observations for each industry-year (Datastream level-six). $DAC_{i,t} = \frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1\left(\frac{1}{A_{i,t-1}}\right) + \hat{\beta}_2\left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}}\right) + \hat{\beta}_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right)\right]$; where $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are coefficients estimated by the model: $\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$; $AC_{i,t}$ is total accruals which equals to net income before extraordinary items minus net cash flows from operations; $A_{i,t-1}$ is total assets of firm *i* at the end of year *t–1;* $\Delta REV_{i,t}$ and $\Delta REC_{i,t}$ are change in sales and change in receivables from year *t–1* to year *t* of firm *i*, respectively; $PPE_{i,t}$ is gross plant, property and equipment of firm *i* at the end of year *t.*

absDAMP	Absolute values of discretionary working capital accruals (DAMP) estimated by the margin model of Peasnell et al. (2000b) with at least ten observations for each industry-year (Datastream level-six). DAMP are residuals of the following regression: $\frac{WAC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{REV_{i,t}}{A_{i,t-1}}\right) + \beta_2\left(\frac{REV_{i,t}-\Delta REC_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$; $WAC_{i,t}$ is working capital accruals, $WAC_{i,t} = (\Delta CA_{i,t} - \Delta CHE_{i,t}) - (\Delta CL_{i,t} - \Delta STD_{i,t})$ [$\Delta CA_{i,t}$ is change in current assets; $\Delta CHE_{i,t}$ is change in cash and cash equivalents; $\Delta CL_{i,t}$ is change in current liabilities; $\Delta STD_{i,t}$ is change in short-term debts]; $A_{i,t-1}$ is total assets of firm *i* at the end of year *t–1;* $REV_{i,t}$ is sales of firm *i* in year *t*; $\Delta REC_{i,t}$ is in receivables from year *t–1* to year *t* of firm *i*.
absDDISEXP	Absolute values of abnormal discretionary expenditures (DDISEXP). DDISEXP are residuals of the following regression with at least ten observations for each industry-year (Datastream level-six): $\frac{\mathrm{DISEXP_{i,t}}}{\mathrm{A_{i,t-1}}} = \alpha\frac{1}{\mathrm{A_{i,t-1}}} + \beta_1\frac{\mathrm{REV_{i,t-1}}}{\mathrm{A_{i,t-1}}} + \varepsilon_{\mathrm{i,t}}$; $DISEXP_{i,t}$ is discretionary expenditures of firm *i* in year *t*, which equals to selling and administrative expenses plus research and development expenses; A_{it-1} is total assets of firm *i* at the end of year *t-1*; $REV_{i,t-1}$ is change in sales of firm *i* from year *t-1* to year *t*.
absDWAC	Absolute value of discretionary working capital accruals (DWAC) estimated by the modified-Jones models (Dechow et al., 1995; Jones, 1991) with at least ten observations for each industry-year (Datastream level-six). $DWCA_{i,t} = \frac{WAC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1\left(\frac{1}{A_{i,t-1}}\right) + \hat{\beta}_2\left(\frac{\Delta REV_{i,t}-\Delta REC_{i,t}}{A_{i,t-1}}\right) + \hat{\beta}_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right)\right]$; where $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are coefficients estimated by the model: $\frac{WAC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$; $WAC_{i,t}$ is working capital accruals, $WAC_{i,t} = (\Delta CA_{i,t} - \Delta CHE_{i,t}) - (\Delta CL_{i,t} - \Delta STD_{i,t})$ [$\Delta CA_{i,t}$ is change in current assets; $\Delta CHE_{i,t}$ is change in cash and cash equivalents; $\Delta CL_{i,t}$ is change in current liabilities; $\Delta STD_{i,t}$ is change in short-term debts]; $A_{i,t-1}$ is total assets of firm *i* at the end of year *t–1;* $\Delta REV_{i,t}$ and $\Delta REC_{i,t}$ are change in sales and change in receivables from year *t–1* to year *t* of firm *i*

	respectively; $PPE_{i,t}$ is gross plant, property and equipment of firm *i* at the end of year *t*.
absDPROD	Absolute values of abnormal production costs (DPROD). DPROD are residuals of the following regression with at least ten observations for each industry-year (Datastream level-six): $\frac{PROD_{it}}{A_{i,t-1}} = \alpha \frac{1}{A_{i,t-1}} + \beta_1 \frac{REV_{i,t}}{A_{i,t-1}} + \beta_2 \frac{\Delta REV_{i,t}}{A_{i,t-1}} + \beta_3 \frac{\Delta REV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t}$; where $PROD_{i,t}$ is production costs of firm *i* in year *t*, which equals to sum of cost of goods sold and change in inventories from year *t-1* to year *t*; $REV_{i,t}$ is sales of firm *i* in year *t*; ΔREV_{it} is change in sales of firm *i* from year *t-1* to year *t*; ΔREV_{it-1} is change in sales of firm *i* from year *t-2* to year *t-1*; A_{it-1} is total assets of firm *i* at the end of year *t-1*.
absREM	Absolute values of total real earnings management (REM); where $REM_{i,t} = -DCF_{i,t} + DPROD_{i,t} - DDISEXP_{i,t}$.
FSD_SCORE	Mean absolute deviation of the first digits of figures reported in financial statements of firm *i* in year *t*. $FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9} \lvert OBSERVED_{d,i,t} - EXPECTED_d \rvert}{9}$; where: $OBSERVED_{d,i,t}$ is the observed (actual) probability of digit *d* of firm *i* in year *t*; $EXPECTED_d$ is the expected probability of first digit *d* as defined by Benford's Law; and *d* = 1, 2, …, 9.
Control variables	
aBDIND	industry-adjusted board independence, where board independence is the percentage of independent directors in a board.
aACIND	industry-adjusted audit committee independence, where audit committee independence is the percentage of independent members in an audit committee.
aLEV	The industry-adjusted leverage (LEV) of firm *i* at the end of fiscal year *t-1*. $LEV = (DLTT + DLC)/A$; where DLTT is long-term debts of firm i at the end of fiscal year t-1; DLC is short-term debts of firm i at the end of fiscal year t-1, A is total assets at the end of fiscal year t-1.

aLOGMBT	the industry-adjusted market-to-book ratio, where the market-to-book ratio *(LOGMTB)* is defined as the natural log of the ratio of market value divided by book value of equity of firm *i* at the end of fiscal year *t-1*.
aLOGMVE	the industry-adjusted firm size, where firm size *(LOGMVE)* equals to natural log of the market value of equity of firm *i* at the end of fiscal year *t-1*.
aNOA	the industry-adjusted net operating asset ratio (NOA) of firm *i* at the end of year *t-1;* where $NOA = [CEQ + (DLTT + DLC) - CHE]/REV$, where: CEQ is total book value of equity; DLTT is long-term debts; DLC is short term debts; CHE is cash and cash equivalent, all measured at the end of fiscal year t-1; REV is sales in year t-1.
AUDIT	equals to one if firm *i* in year *t* is audited by a Big Four audit firm, zero otherwise.
DISTRESS	equals to one if ZSCORE of firm *i* in year *t-1* is negative, zero otherwise; where ZSCORE is estimated as explained in Taffler (1983): ZSCORE following Taffler (1983) is as follows: $\text{ZSCORE} = 3.2 + 12.18 * X_1 + 2.50 * X_2 - 10.68 * X_3 + 0.029 * X_4$; where $X_1 = \frac{\text{Profit before tax}}{\text{current liabilities}}$; $X_2 = \frac{\text{Current assets}}{\text{Total liabilities}}$; $X_3 = \frac{\text{Current liabilities}}{\text{Total assets}}$; $X_4 = \frac{(\text{Quick assets} - \text{Current liabilities})}{(\text{Sales} - \text{Pretax income} - \text{Depreciation})/365}$
CYCLE	equals to one if a firm has all negative cash flows from operating, investing and financing activities (young firm) in year *t*, or has negative cash flows from operating activities and positive cash flows from both investing and financing activities (growth firm) in year *t*, zero otherwise.
M&A	equals to one if firm *i* announces a share-financed merger and acquisition deal in year *t*, zero otherwise.
SEO	equals to one if firm *i* issues a significant portion of equity in year *t* (outstanding shares increase at least 5% and proceeds from equity issuance are positive), zero otherwise.

Table 1. Descriptive Statistics

Statistics	N	MIN	MAX	MEAN	STD	MEDIAN	P25	P75
Panel A: Firm characteristics								
Total assets$_{i,t}$ (£'000)	3396	1,392	28,411,781	990,192	3,623,169	79,632	18,599	419,650
Sales$_{i,t}$ (£'000)	3396	17	18,057,594	792,155	2,393,480	78,888	14,404	421,338
Net income before extraordiany items$_{i,t}$ (£'000)	3396	-84,000	2,875,916	66,335	327,540	2,535	-479	22,022
Market values$_{i,t}$ (£'000)	3396	1,222	40,444,127	1,065,417	4,692,480	62,107	15,566	389,453
Market to book ratio$_{i,t}$	3396	0.1815	21.7704	2.8619	3.3567	1.7818	1.0306	3.2930
Leverage$_{i,t}$	3396	0	0.5929	0.1483	0.1492	0.1148	0.0051	0.2407
Panel B: Individual factors of PSCORE								
pCFO$_{i,t}$	3396	0	1	0.8251	0.3799	1	1	1
pCERT$_{i,t}$	3396	0	1	0.6393	0.4803	1	0	1
pROLE$_{i,t}$	3396	0	1	0.5339	0.4989	1	0	1
pPRESS$_{i,t}$	3396	0	1	0.7697	0.4211	1	1	1
pROA$_{i,t}$	3396	0	1	0.1820	0.3859	0	0	0
pEARLY$_{i,t}$	3396	0	1	0.2488	0.4324	0	0	0
pFOUNDER$_{i,t}$	3396	0	1	0.1628	0.3693	0	0	0
pCHAIRMAN$_{i,t}$	3396	0	1	0.1007	0.3010	0	0	0
pAGE$_{i,t}$	3396	0	1	0.3442	0.4752	0	0	1
Panel C: Earnings management proxies								
absDAC$_{i,t}$	3396	0.0010	0.5185	0.0782	0.0877	0.0503	0.0241	0.0991
absDWAC$_{i,t}$	3396	0.0007	0.3986	0.0617	0.0703	0.0388	0.0171	0.0786
absDAMP$_{i,t}$	3396	0.0006	0.3827	0.0579	0.0658	0.0371	0.0167	0.0751
absDCF$_{i,t}$	3139	0.0013	1.6551	0.1408	0.2313	0.0769	0.0334	0.1507
absDPROD$_{i,t}$	3014	0.0024	1.0903	0.1780	0.1955	0.1183	0.0525	0.2264
absDDISEXP$_{i,t}$	2650	0.0018	1.4821	0.2031	0.2488	0.1235	0.0502	0.2505
absREM$_{i,t}$	2547	0.0040	2.7164	0.3649	0.4327	0.2380	0.1049	0.4413
FSD_SCORE$_{i,t}$	2810	0.0137	0.0625	0.0324	0.0098	0.0313	0.0253	0.0379
Panel D: Independent variables of main regressions								
PSCORE$_{i,t}$	3396	0	8	3.8065	1.5009	4	3	5
SEO$_{i,t}$	3396	0	1	0.2153	0.4111	0	0	0

$M\&A_{i,t}$	3396	0	1	0.0418	0.2002	0	0	0
$AUDIT_{i,t}$	3396	0	1	0.5642	0.4959	1	0	1
$aBDIND_{i,t}$	3396	-0.4200	0.4370	0.0154	0.2153	0.0422	-0.1477	0.1752
$aACIND_{i,t}$	3396	-0.5000	0.9091	0.0100	0.2739	0.0000	-0.0909	0.0000
$CYCLE_{i,t}$	3396	0	1	0.0259	0.1589	0	0	0
$DISTRESS_{i,t-1}$	3396	0	1	0.2741	0.4461	0	0	1
$aLOGMVE_{i,t-1}$	3396	-3.7015	5.9248	0.2022	1.9650	0.0423	-1.2163	1.3871
$aLOGMTB_{i,t-1}$	3396	-1.9314	2.4059	-0.0365	0.8207	-0.0530	-0.5730	0.4558
$aLEV_{i,t-1}$	3396	-0.6185	0.3844	-0.0272	0.1568	-0.0472	-0.1205	0.0709
$aNOA_{i,t-1}$	3396	-113.0504	61.4047	-2.3055	16.7590	-0.1371	-0.5842	0.2959

Note: Panel A, B, C, and D reports the number of observations (N), minimum (MIN), maximum (MAX), mean (MEAN), standard deviation (STD), median (MEDIAN), 25^{th} (P25), and 75^{th} (P75) percentiles of firm characteristics, individual factors of PSCORE, proxies of earnings management, and variables of main regressions. Definitions of variables are in the Appendix.

Table 2: Aggregate conformity to Benford's Law

First digit	Number of first digits	Expected frequencies	Observed frequencies	Deviations
(a)	(b)	(c)	(d)	(e)
1	118,066	0.3010	0.3030	0.0020
2	69,195	0.1761	0.1776	0.0015
3	49,091	0.1249	0.1260	0.0011
4	37,363	0.0969	0.0959	0.0010
5	31,084	0.0792	0.0798	0.0006
6	25,578	0.0670	0.0656	0.0013
7	22,391	0.0580	0.0575	0.0005
8	19,595	0.0512	0.0503	0.0009
9	17,256	0.0458	0.0443	0.0015
Total	389,619			
FSD_SCORE				0.0011

Note: the table reports the aggregate FSD_SCORE of UK listed companies for the period from 2005 to 2012. Column (a) shows the first digits being analysed. Column (b) shows the number of first digits being analysed in the sample. Column (c) shows the theoretical distributions of the first digits following Benford's Law. Column (d) shows the observed (actual) distributions of the first digits in the sample. Column (e) shows deviations of the first digits from what are expected by Benford's Law, where deviations are defined as the absolute values of the observed frequencies minus the expected frequencies. FSD_SCORE is the sum of all deviations divided by nine. Definitions of variables are in the Appendix.

Table 3. Pearson Correlations

Variable		9	10	11	12	13	14	15	16	17	18	19	20
absDAC$_{i,t}$	1	0.146	0.200	0.066	-0.194	-0.113	-0.083	0.073	0.122	-0.158	0.057	-0.108	*0.001*
absDWAC$_{i,t}$	2	0.137	0.188	0.123	-0.162	-0.116	-0.072	0.078	0.080	-0.159	0.112	-0.112	*-0.022*
absDAMP$_{i,t}$	3	0.158	0.173	0.124	-0.170	-0.113	-0.081	0.048	0.057	-0.161	0.117	-0.111	*-0.001*
absDCF$_{i,t}$	4	0.112	0.098	0.035		-0.043	*0.012*	0.059	0.119	-0.039	0.122	-0.080	
absDPROD$_{i,t}$	5	0.085	*0.009*	0.066		-0.051	*-0.021*	0.058	*0.032*	-0.082	0.178	-0.077	
absDDISEXP$_{i,t}$	6	0.100	0.097	0.050		-0.071	*-0.021*	0.050	0.106	-0.096	0.152	-0.134	
absREM$_{i,t}$	7	0.094	*0.017*	0.055		-0.047	*0.017*	*0.023*	*0.037*	-0.052	0.160	-0.108	
FSD_SCORE$_{i,t}$	8	0.1716	0.0939	*-0.0124*	-0.2063	-0.1492	-0.1037	*0.0278*	0.1374	-0.2370	0.0486	-0.1310	*0.0047*
PSCORE$_{i,t}$	9	1											
SEO$_{i,t}$	10	0.163	1										
M&A$_{i,t}$	11	*0.018*	0.195	1									
AUDIT$_{i,t}$	12	-0.260	-0.142	*-0.015*	1								
aBDIND$_{i,t}$	13	-0.251	-0.122	*0.009*	0.367	1							
aACIND$_{i,t}$	14	-0.196	-0.089	*-0.014*	0.248	0.326	1						
CYCLE$_{i,t}$	15	0.067	0.063	0.040	-0.058	*-0.031*	-0.048	1					
DISTRESS$_{i,t-1}$	16	0.171	0.256	*-0.003*	-0.108	-0.150	-0.112	0.112	1				
aLOGMVE$_{i,t-1}$	17	-0.350	-0.212	*-0.024*	0.465	0.590	0.462	-0.108	-0.263	1			
aLOGMTB$_{i,t-1}$	18	*-0.018*	*-0.019*	*0.009*	0.056	0.092	0.173	*-0.030*	*-0.003*	0.340	1		
aLEV$_{i,t-1}$	19	-0.129	*0.030*	*-0.031*	0.166	0.105	0.122	-0.037	0.036	0.194	*0.019*	1	
aNOA$_{i,t-1}$	20	*0.018*	*0.011*	*0.003*	-0.044	-0.102	-0.075	*0.008*	*0.018*	-0.128	*-0.018*	-0.047	1

Note: The table reports the Pearson correlation coefficients between selected variables. The values reported in italic indicate the corresponding coefficients are not significant at 5% level. Definitions of variables are in the Appendix.

Table 4. Principal Component Analysis

Panel A: Correlation Matrix of individual factors of PSCORE

	pCFO$_{i,t}$	pCERT$_{i,t}$	pROLE$_{i,t}$	pPRESS$_{i,t}$	pROA$_{i,t}$	pEARLY$_{i,t}$	pFOUNDER$_{i,t}$	pCHAIRMAN$_{i,t}$	pAGE$_{i,t}$
pCFO$_{i,t}$	1								
pCERT$_{i,t}$	0.4822	1							
pROLE$_{i,t}$	-0.0449	*0.0012*	1						
pPRESS$_{i,t}$	0.0335	0.0596	*0.0189*	1					
pROA$_{i,t}$	0.0243	0.0507	0.0919	0.0404	1				
pEARLY$_{i,t}$	0.0678	*0.0224*	0.5159	*0.0187*	0.1116	1			
pFOUNDER$_{i,t}$	0.0918	0.0905	-0.1426	-0.0391	0.0318	-0.0730	1		
pCHAIRMAN$_{i,t}$	0.0433	0.0333	-0.0463	0.0366	*0.0045*	*-0.0115*	0.0777	1	
pAGE$_{i,t}$	*-0.0025*	*-0.0185*	0.0869	0.0312	*0.0117*	0.0489	0.0380	*-0.0118*	1

Panel B: Eigen values of the Correlation Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	1.6077	0.0634	0.1786	0.1786
2	1.5443	0.4907	0.1716	0.3502
3	1.0537	0.0357	0.1171	0.4673
4	1.0180	0.0240	0.1131	0.5804
5	0.9940	0.0301	0.1104	0.6909
6	0.9640	0.1356	0.1071	0.7980
7	0.8284	0.2829	0.0920	0.8900
8	0.5455	0.1010	0.0606	0.9506
9	0.4445		0.0494	1.0000

Panel C: Eigen vectors

	Prin1	Prin2	Prin3	Prin4	Prin5	Prin6	Prin7	Prin8	Prin9
pCFO$_{i,t}$	-0.0011	0.6662	-0.1929	-0.0468	0.0852	0.0672	-0.1056	-0.5705	0.4104
pCERT$_{i,t}$	0.0061	0.6660	-0.1946	0.0046	0.0731	-0.0011	-0.0903	0.6172	-0.3523
pROLE$_{i,t}$	0.6674	-0.0309	-0.0104	-0.0730	-0.0396	0.1430	0.1291	0.3894	0.5982
pPRESS$_{i,t}$	0.0724	0.1169	0.1951	0.8550	0.2369	-0.1135	0.3763	-0.0350	0.0173
pROA$_{i,t}$	0.2156	0.1259	0.3403	0.0285	-0.3359	-0.7664	-0.3454	-0.0268	0.0284
pEARLY$_{i,t}$	0.6494	0.0757	0.0150	-0.1098	-0.1281	0.1497	0.2117	-0.3692	-0.5834

$pFOUNDER_{i,t}$	-0.2298	0.2396	0.5048	-0.4153	-0.0628	-0.0884	0.6661	0.0494	0.0680
$pCHAIRMAN_{i,t}$	-0.0891	0.1379	0.5101	0.2182	-0.4843	0.5806	-0.3035	0.0337	0.0147
$pAGE_{i,t}$	0.1427	-0.0007	0.5056	-0.1689	0.7496	0.0858	-0.3502	-0.0129	-0.0579

Note: The table reports results of the principal component analysis. Panel A reports the correlations between individual factors. The values reported in italic indicate the corresponding coefficients are not significant at 5% level. Panel B (C) reports the Eigen values (vectors) of the correlation matrix resulted from the principal component analyses on nine individual components of the PSCORE. Definitions of variables are in the Appendix.

Table 5. Earnings management by each group of PSCORE

$PSCORE_{i,t}$	N	$absDAC_{i,t}$	$absDWAC_{i,t}$	$absDAMP_{i,t}$	absDCF	$absDCF_{i,t}$	$absDPROD_{i,t}$	$absREM_{i,t}$	$FSD\_SCORE_{i,t}$
0	38	0.0366	0.0289	0.0288	0.0636	0.1030	0.1207	0.1873	0.0297
1	156	0.0598	0.0573	0.0432	0.1020	0.1474	0.1578	0.2946	0.0296
2	443	0.0615	0.0523	0.0480	0.1081	0.1540	0.1596	0.2907	0.0305
3	832	0.0737	0.0559	0.0535	0.1343	0.1745	0.1957	0.3616	0.0313
4	827	0.0788	0.0572	0.0523	0.1366	0.1847	0.2030	0.3773	0.0328
5	663	0.0853	0.0699	0.0696	0.1464	0.1817	0.2242	0.3779	0.0332
6	307	0.0958	0.0781	0.0727	0.2033	0.2043	0.2507	0.4258	0.0356
7	116	0.1108	0.0891	0.0890	0.1997	0.2173	0.2363	0.4722	0.0368
8	14	0.1639	0.1278	0.0829	0.2515	0.2369	0.1335	0.3394	0.0394
High (PSCORE=6,7,8)	437	0.1020	0.0774	0.2038	0.2432	0.2088	0.0827	0.4353	0.0360
Low (PSCORE=0,1,2)	637	0.0596	0.0457	0.1043	0.1570	0.1497	0.0521	0.2858	0.0302
Difference (high-low)		0.0424	0.0317	0.0995	0.0863	0.0591	0.0305	0.1495	0.0058
t-statistics		7.477***	7.052***	6.068***	4.756***	4.233***	6.279***	4.42***	8.531***

Note: The table reports the means by each PSCORE for each proxy of earnings management. The last four rows of the table show means of the high-PSCORE and the low-PSCORE groups, mean differences between two groups and t-statistics obtained from t-tests tests under the null that the difference is zero. Variable definitions are in the Appendix.

∗ Significance at the 10% level.
∗∗ Significance at the 5% level.
∗∗∗ Significance at the 1% level.

Table 6. PSCORE and accrual earnings management

Variable	Expected sign	absDAC Coefficient	absDAC t-statistic		absDWAC Coefficient	absDWAC t-statistic		absDAMP Coefficient	absDAMP t-statistic	
Intercept	?	0.0675	13.93	***	0.0529	13.7	***	0.0477	13.19	***
$PSCORE_{i,t}$	+	0.0031	2.95	***	0.0021	2.47	**	0.0031	4.02	***
$SEO_{i,t}$	+	0.0313	8.33	***	0.0224	7.47	***	0.0186	6.62	***
$M\&A_{i,t}$	+	0.0128	1.74	*	0.0306	5.22	***	0.0300	5.49	***
$AUDIT_{i,t}$	-	-0.0213	-6.34	***	-0.0098	-3.67	***	-0.0102	-4.06	***
$aBDIND_{i,t}$	-	-0.0002	-0.01		-0.0013	-0.18		0.0029	0.47	
$aACIND_{i,t}$	-	-0.0022	-0.36		0.0012	0.26		-0.0010	-0.22	
$CYCLE_{i,t}$	+	0.0225	2.46	**	0.0215	2.94	***	0.0081	1.19	
$DISTRESS_{i,t-1}$	+	0.0094	2.7	***	-0.0004	-0.12		-0.0036	-1.39	
$aLOGMVE_{i,t-1}$	-	-0.0021	-1.83	*	-0.0044	-4.75	***	-0.0043	-5.01	***
$aLOGMTB_{i,t-1}$	+	0.0093	4.84	***	0.0138	9.04	***	0.0136	9.5	***
$aLEV_{i,t-1}$	?	-0.0433	-4.55	***	-0.0338	-4.46	***	-0.0285	-4.02	***
$aNOA_{i,t-1}$	-	-0.0001	-1		-0.0002	-2.65	***	-0.0001	-1.35	
N		3,396			3,396			3,396		
Adjusted R^2 (%)		8.92			9.97			9.94		

Note: The table reports the estimations of the following equation: $EM_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} + \beta_{10} aLOGMTB_{i,t-1} + 11 aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon$, where $EM_{i,t}$ is $absDAC_{i,t}$, $absDWAC_{i,t}$ or $absDAMP_{i,t}$. Definitions of variables are in the Appendix.

∗ Significance at the 10% level.

∗∗ Significance at the 5% level.

∗∗∗ Significance at the 1% level.

Table 7. PSCORE and real earnings management

Variable	Expected sign	absDCF Coefficient	absDCF t-statistic		absDPROD Coefficient	absDPROD t-statistic		absDDISEXP Coefficient	absDDISEXP t-statistic		absREM Coefficient	absREM t-statistic	
Intercept	?	0.0719	5.89	***	0.1645	15.81	***	0.1563	11.02	***	0.0253	0.0000	***
$PSCORE_{i,t}$	+	0.0118	4.02	***	0.0047	1.87	*	0.0062	1.85	*	0.0061	0.0022	***
$SEO_{i,t}$	+	0.0351	3.35	***	-0.0152	-1.67	*	0.0336	2.79	***	0.0216	0.4861	
$M\&A_{i,t}$	+	0.0193	0.95		0.0576	3.3	***	0.0374	1.63		0.0412	0.0119	**
$aBDIND_{i,t}$	-	-0.0172	-0.73		0.0261	1.3		-0.0033	-0.12		0.0474	0.8228	
$aACIND_{i,t}$	-	0.0367	2.18	**	0.0135	0.94		0.0324	1.64		0.0352	0.0096	***
$CYCLE_{i,t}$	+	0.0589	2.31	**	0.0528	2.42	**	0.0456	1.6		0.0510	0.5204	
$DISTRESS_{i,t-1}$	+	0.0461	4.66	***	-0.0022	-0.24		0.0345	3.03	***	0.0205	0.4071	
$aLOGMVE_{i,t-1}$	-	-0.0008	-0.25		-0.0165	-6.28	***	-0.0128	-3.58	***	0.0064	0.0013	***
$aLOGMTB_{i,t-1}$	+	0.0347	6.49	***	0.0559	12.08	***	0.0557	9.1	***	0.0111	0.0000	***
$aLEV_{i,t-1}$	?	-0.1115	-4.22	***	-0.0595	-2.62	***	-0.1838	-6.13	***	0.0538	0.0000	***
N		3,139			3,014			2,650			2,547		
Adjusted R^2 (%)		4.80			6.30			6.83			5.20		

Note: The table reports the estimations of the following equation: $RM_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$ where $RM_{i,t}$ is $absDCF_{i,t}$, $absDPROD_{i,t}$, $absDDISEXP_{i,t}$ or $absREM_{i,t}$. Definitions of variables are in the Appendix.

∗ Significance at the 10% level.

∗∗ Significance at the 5% level.

∗∗∗ Significance at the 1% level.

Table 8. PSCORE and FSD_SCORE

Variable	Expected sign	Pooled regressions (a)			Year fixed effect (b)			Industry fixed effect (c)			Industry-year fixed effect (d)		
		Coefficient	t-statistic		Coefficient	t-statistic		Coefficient	t-statistic		Coefficient	t-statistic	
Intercept	?	0.0424	30.06	***									
$PSCORE_{i,t}$	+	0.0003	2.47	**	0.0003	2.59	***	0.0003	2.3	**	0.0003	2.4	**
$SEO_{i,t}$	+	0.0004	0.77		0.0004	0.81		-0.0001	-0.11		0.0000	-0.03	
$M\&A_{i,t}$	+	-0.0015	-1.69	*	-0.0014	-1.54		-0.0014	-1.58		-0.0013	-1.45	
$AUDIT_{i,t}$	-	-0.0013	-3.08	***	-0.0013	-3.07	***	-0.0011	-2.57	***	-0.0011	-2.56	**
$aBDIND_{i,t}$	-	-0.0009	-0.96		-0.0009	-0.94		0.0009	0.95		0.0010	0.98	
$aACIND_{i,t}$	-	0.0006	1.02		0.0001	0.14		0.0006	1.03		0.0001	0.21	
$CYCLE_{i,t}$	+	-0.0001	-0.09		-0.0002	-0.19		-0.0005	-0.47		-0.0007	-0.58	
$DISTRESS_{i,t-1}$	+	0.0014	3.38	***	0.0014	3.35	***	0.0012	2.75	***	0.0012	2.74	***
$aLOGMVE_{i,t-1}$	-	-0.0010	-7.66	***	-0.0009	-7.32	***	-0.0013	-9.1	***	-0.0013	-8.83	***
$aLOGMTB_{i,t-1}$	+	0.0013	6.68	***	0.0014	6.78	***	0.0016	7.52	***	0.0017	7.55	***
$aLEV_{i,t-1}$	?	-0.0046	-3.81	***	-0.0044	-3.6	***	-0.0042	-3.19	***	-0.0041	-3.05	***
$aNOA_{i,t-1}$	-	0.0000	2.54	**	0.0000	2.44	**	0.0000	2.28	**	0.0000	2.18	**
YEAR DUMMY		NO			YES			NO			YES		
INDUSTRY DUMMY		NO			NO			YES			YES		
N		2,810			2,810			2,810			2,810		
Adjusted R^2		10.72			11.35			15.07			15.34		

Note: The table reports the estimations of the regressions between PSCORE and FSD_SCORE.

Column (a) reports findings of the pooled regression without fixed effect: $FSD\_SCORE_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + \varepsilon.$

Column (b) reports findings of the regression with year fixed effect: $FSD\_SCORE_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + YEAR\ FIXED\ EFFECTS + \varepsilon.$

Column (c) reports findings of the regression with industry fixed effect: $FSD\_SCORE_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + INDUSTRY\ FIXED\ EFFECTS + \varepsilon.$

Column (d) reports findings of the regression with industry-year fixed effect: $FSD\_SCORE_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + YEAR\ FIXED\ EFFECTS + INDUSTRY\ FIXED\ EFFECTS + \varepsilon$.

$*$ Significance at the 10% level.
$**$ Significance at the 5% level.
$***$ Significance at the 1% level.

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